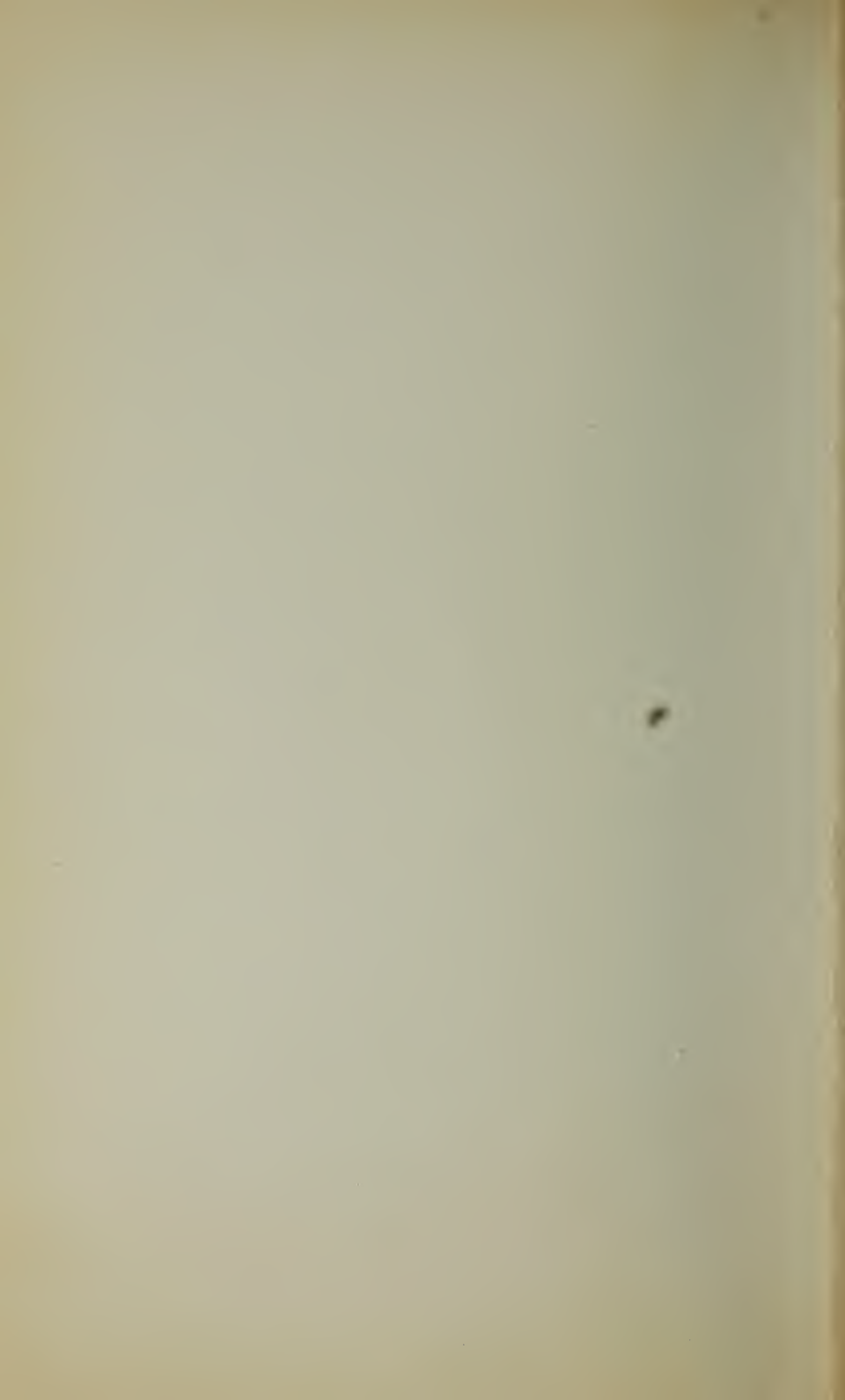


Faculty of Graduate Studies
and Research

Carleton University

Calendar
1989-90







Carleton University

Faculty of Graduate Studies
and Research
1989-90
Calendar

4

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Ottawa, Canada K1S 5B6
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Office of the Dean

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Dean of Graduate Studies and Research
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Associate Dean (Research)
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Assistant Dean
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Office Hours
September 1 to April 30
9:00 A.M. to 12:00 noon
1:00 P.M. to 5:00 P.M.

May 1 to August 31
8:30 A.M. to 12:00 noon
1:00 P.M. to 4:30 P.M.

As this calendar is published several months before the opening of the session, the University reserves the right to make whatever changes circumstances may require, including cancellation of particular courses.

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CARLETON UNIVERSITY

- A Physical Recreation Centre
- B Environmental Laboratories
- C Maintenance Building
- E St. Patrick's Building
- F University Commons
- G Gleggery House
- H Grenville House
- I Russell House
- J Lusk House
- K Renfrew House
- L MacKenzie (Engineering) Building
- M Architecture Building
- N University Centre
- O Tory (Science) Building
- P Dunton Tower
- Q MacOdrum Library
- R Southam Hall
- S Alumni Theatre
- T Social Sciences Research Building
- U Loeb Building
- V Pearson Hall
- W Herzberg Laboratories for Physics
- X Science (Library) Building

- BUS STOP
- ▲ TUNNEL ENTRANCE
- ◆ BOOKSTORE & COMPUTER STORE
- BANK
- POST OFFICE



The University

Carleton University

Ottawa, the capital of Canada, is a medium-sized, non-industrial city located at the junction of the Ottawa, Gatineau, and Rideau rivers. Excellent skiing facilities, water recreation areas, and scenic areas are located in the Gatineau Hills a few minutes away from the campus. The National Arts Centre with its own orchestra, the National Gallery of Canada, and other such institutions give the city a well-rounded cultural environment. Entertainment is available in both of Canada's official languages, French and English.

Carleton is a university old enough to have an established reputation, yet young enough to combine its tradition with innovation in ways to meet the diverse needs of modern students.

Founded in 1942 as a non-denominational, private and co-educational college, Carleton initially occupied scattered rented quarters in downtown Ottawa, but by 1946 it had moved to a permanent building in central Ottawa. As the University expanded, it became necessary to plan and develop a new campus located on a large and picturesque site between the Rideau River and the Rideau Canal.

The University awarded its first degrees in 1946, but it did not offer programs of graduate studies until 1954. Carleton's first undergraduate degrees, awarded in 1946, were in journalism and in public administration; its first graduate diploma in 1954 was in public administration. Now, more than 30 years after the beginnings of its graduate studies, the University also offers graduate instruction leading to the master's degree in some 33 areas and to the doctorate in 14 fields. In 1988-89, Carleton registered 1,224 full-time graduate students. In addition, 884 students were registered for part-time graduate studies.

Carleton has set as its major goals in graduate studies the promotion of a spirit of independent investigation and the pursuit of scholarly work of consistently high quality. By concentrating on certain fields of studies to the exclusion of others and by electing areas in which it had a comparative advantage, the University has been able to ensure a great measure of success in the pursuit of these goals.

Carleton University has a good base of operation at the graduate level: outstanding scholars, challenging and imaginative programs of studies, students of high quality, libraries, laboratories and other research facilities. Moreover, the location of the University in the capital of Canada also enables graduate students to have access to the vast number of scholars working in government organizations and departments, and to

take advantage of research and library facilities associated with these national institutions.

Carleton University is a community of faculty, staff and students who are engaged in teaching, learning, and research. Its members are part of the community at large and are governed by the law common to all persons. But membership in the academic community also entails certain rights and responsibilities. The University respects the rights of speech, assembly, and dissent; it prohibits discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, age, marital status, family status, political affiliation or belief, sexual orientation, or any handicap that is defined as such in the Human Rights Code of Ontario; it requires tolerance and respect for the rights of others; and it promotes an environment conducive to personal and intellectual growth.

Degree Programs

The following graduate programs are currently offered at Carleton:

Graduate Diploma in Public Administration (D.P.A.)

Master of Arts (M.A.)

In Anthropology, Canadian Studies, Classics, Comparative Literature, Economics, English, French, Geography, German, History, International Affairs, Philosophy, Political Science, Psychology, Public Administration, Religion, Spanish, Sociology, and Soviet and East European Studies

Master of Computer Science (M.C.S.)

Master of Engineering (M.Eng.)

In Aeronautical, Civil, Electrical, Mechanical, and Materials Engineering

Master of Journalism (M.J.)

Master of Management Studies (M.M.S.)

Master of Science (M.Sc.)

In Biology, Chemistry, Geology, Information and Systems Science, Mathematics, and Physics

Master of Social Work (M.S.W.)

Doctor of Philosophy (Ph.D.)

In Biology, Chemistry, Economics, Engineering (Aeronautical, Civil, Electrical, and Mechanical), Geology, History, Mathematics, Physics, Political Science, Psychology, and Sociology

Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and the dress of the ancient foundations of Britain and America.

The master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: arts — white; journalism — white with a black cord sewn slightly in from the lower border; management studies — camel brown with a black cord sewn slightly in from the lower border; science — golden yellow; computer science — royal blue; social work — cream; engineering — orange. The master's gown is of full style, made of black silk or rayon, with full gathered yoke behind and closed sleeves with an opening at the elbows.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The doctoral gown has the same style as the master's and is made of royal blue cloth with facings of light blue silk.

The gown of the Honorary Doctorate of Laws, of Literature, of Science, or of Engineering is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, vibrant blue for the degree of Doctor of Literature, dark red for the degree of Doctor of Science, and orange for the degree of Doctor of Engineering.

Academic Schedule

The following schedule of dates is anticipated for academic activities and procedures; however, it is subject to final confirmation by the University Senate.

Students in the Joint Programs and Visiting Graduate Program should also check with the University of Ottawa for confirmation of their academic schedule.

Spring Term and Summer Session 1989

May 16 and 17

Registration for spring term.

May 17

Spring-term classes begin (summer-evening full-session and first-term classes).

May 22

Statutory holiday. University closed.

May 26

Last day for late registration for spring term.

Last day for course changes for first-term evening-division courses and for evening-division full-session courses. Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office *must* Rregister.

June 8, 9 and 10

Spring Convocation for the conferring of degrees.

June 16

Last day for withdrawal from first-term evening-division courses.

June 27

Last day for first-term evening-division classes.

June 28, 29

First-term evening-division final examinations.

July 3

Statutory holiday. University closed.

July 4

Registration for summer-session classes. Summer-session day classes and second-term evening classes begin.

July 7

Last day for late registration and course changes for second-term evening-division courses and for day-division courses.

July 28

Last day for withdrawal from day-division courses, second-term evening-division courses and full-session evening-division courses.

August 7

Civic holiday. University closed.

August 11

Last day for spring-term and summer-session classes.

August 12, 14 and 15

Spring-term and summer-session examinations.

Fall Term 1989

June 1

Last day for the receipt of applications for fall-term registration from candidates whose documents originate outside Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by June 30. Applications from candidates in this category who intend to register initially for the winter term must be received by October 1, and for the spring term by February 1.

July 1

Last day for receipt of applications for fall-term registration from candidates resident in Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by July 31. Applications from candidates resident in Canada who intend to register initially for the winter term must be received by November 1; and for the spring term by April 1.

August 1

Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Fall Convocation.

September 1

Last day for receipt of applications for degrees from potential graduates for Fall Convocation.

September 4

Statutory holiday. University closed.

September 8

Last day to complete registration, including fee payment, for fall/winter session without incurring a late registration fee.

September 11

Fall term classes begin for graduate students (note: undergraduate classes begin on September 7).

September 22

Last day for late registration for fall term. Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office *must* register.

Last day for course changes for fall/winter and fall term courses.

October 9

Statutory holiday. University closed.

October 13

Last day for submission to the Graduate Studies and Research Office of five final copies of master's and Ph.D. theses for Fall Convocation.

November

Fall Convocation for the conferring of degrees; date to be announced.

November 10

Last day for withdrawal from fall-term courses.

December 1

Last day for receiving applications for degrees from potential graduates for Winter Graduation.

Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Winter Graduation.

December 7-22

Final examinations in fall courses and mid-term examinations in fall/winter courses, may be scheduled as announced.

December 8

Last day for fall-term classes (note: undergraduate courses end on December 6).

March 1

Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April) of financial assistance (including Carleton fellowships, scholarships, and departmental assistantships) administered by Carleton University. Candidates whose applications are received after the March 1 deadline date may be eligible for the award of a fellowship, scholarship, or assistantship by reversion.

Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Spring Convocation.

March 16

Last day for withdrawal from fall/winter and winter-term courses.

April 10

Last day for winter-term classes.

April 12-30

Final examinations may be scheduled as announced.

April 13

Statutory holiday. University closed.

May 15

Last day for submission to the Graduate Studies and Research Office of five final copies of master's and Ph.D. theses for Spring Convocation.

Winter Term 1990

January 3

Winter-term classes begin.

January 5

Last day to complete registration, including fee payment, for fall/winter session winter-term courses, without incurring a late registration fee.

January 19

Last day for late registration for winter term. Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office must register.

Last day for course changes for winter-term courses.

January 30

Last day for submission to the Graduate Studies and Research Office of five final copies of master's and Ph.D. theses for Winter Graduation.

February 1

Last day for receiving applications for degrees from potential graduates for Spring Convocation.

February 19-23

Study period — classes suspended.

1989

S	M	T	W	T	F	S	S	M	T	W	T	F	S
January							February						
1	2	3	4	5	6	7			1	2	3	4	
8	9	10	11	12	13	14	5	6	7	8	9	10	11
15	16	17	18	19	20	21	12	13	14	15	16	17	18
22	23	24	25	26	27	28	19	20	21	22	23	24	25
29	30	31					26	27	28				
March							April						
	1	2	3	4								1	
5	6	7	8	9	10	11	2	3	4	5	6	7	8
12	13	14	15	16	17	18	9	10	11	12	13	14	15
19	20	21	22	23	24	25	16	17	18	19	20	21	22
26	27	28	29	30	31		23	24	25	26	27	28	29
							30						
May							June						
	1	2	3	4	5	6					1	2	3
7	8	9	10	11	12	13	4	5	6	7	8	9	10
14	15	16	17	18	19	20	11	12	13	14	15	16	17
21	22	23	24	25	26	27	18	19	20	21	22	23	24
28	29	30	31				25	26	27	28	29	30	
July							August						
					1				1	2	3	4	5
2	3	4	5	6	7	8	6	7	8	9	10	11	12
9	10	11	12	13	14	15	13	14	15	16	17	18	19
16	17	18	19	20	21	22	20	21	22	23	24	25	26
23	24	25	26	27	28	29	27	28	29	30	31		
30	31												
September							October						
				1	2		1	2	3	4	5	6	7
3	4	5	6	7	8	9	8	9	10	11	12	13	14
10	11	12	13	14	15	16	15	16	17	18	19	20	21
17	18	19	20	21	22	23	22	23	24	25	26	27	28
24	25	26	27	28	29	30	29	30	31				
November							December						
	1	2	3	4							1	2	
5	6	7	8	9	10	11	3	4	5	6	7	8	9
12	13	14	15	16	17	18	10	11	12	13	14	15	16
19	20	21	22	23	24	25	17	18	19	20	21	22	23
26	27	28	29	30			24	25	26	27	28	29	30
							31						

1990

S	M	T	W	T	F	S	S	M	T	W	T	F	S
January							February						
	1	2	3	4	5	6					1	2	3
7	8	9	10	11	12	13	4	5	6	7	8	9	10
14	15	16	17	18	19	20	11	12	13	14	15	16	17
21	22	23	24	25	26	27	18	19	20	21	22	23	24
28	29	30	31				25	26	27	28			
March							April						
		1	2	3			1	2	3	4	5	6	7
4	5	6	7	8	9	10	8	9	10	11	12	13	14
11	12	13	14	15	16	17	15	16	17	18	19	20	21
18	19	20	21	22	23	24	22	23	24	25	26	27	28
25	26	27	28	29	30	31	29	30					
May							June						
	1	2	3	4	5						1	2	
6	7	8	9	10	11	12	3	4	5	6	7	8	9
13	14	15	16	17	18	19	10	11	12	13	14	15	16
20	21	22	23	24	25	26	17	18	19	20	21	22	23
27	28	29	30	31			24	25	26	27	28	29	30
July							August						
1	2	3	4	5	6	7				1	2	3	4
8	9	10	11	12	13	14	5	6	7	8	9	10	11
15	16	17	18	19	20	21	12	13	14	15	16	17	18
22	23	24	25	26	27	28	19	20	21	22	23	24	25
29	30	31					26	27	28	29	30	31	
September							October						
					1		1	2	3	4	5	6	
2	3	4	5	6	7	8	7	8	9	10	11	12	13
9	10	11	12	13	14	15	14	15	16	17	18	19	20
16	17	18	19	20	21	22	21	22	23	24	25	26	27
23	24	25	26	27	28	29	28	29	30	31			
30													
November							December						
	1	2	3									1	
4	5	6	7	8	9	10	2	3	4	5	6	7	8
11	12	13	14	15	16	17	9	10	11	12	13	14	15
18	19	20	21	22	23	24	16	17	18	19	20	21	22
25	26	27	28	29	30		23	24	25	26	27	28	29
							30	31					

Course Designation System

Prefix Numbering

Each course number is prefixed by the number or numbers of the department, institute or school under whose auspices the course is offered.

- 11 Art History
- 12 Canadian Studies
- 14 Classics
- 17 Comparative Literature
- 18 English
- 19 Film Studies
- 20 French
- 22 German
- 24 History
- 28 Journalism
- 29 Linguistics
- 30 Music
- 32 Philosophy
- 34 Religion
- 38 Spanish
- 42 Business
- 43 Economics
- 45 Geography
- 46 International Affairs
- 47 Political Science
- 49 Psychology
- 49 Specialization in Neuroscience
- 50 Public Administration
- 51 Law
- 52 Social Work
- 53 Sociology
- 54 Anthropology
- 55 Soviet and East European Studies
- 61 Biology
- 65 Chemistry
- 67 Earth Sciences
- 70 Mathematics and Statistics
- 74 Physics
(*joint program*): offered at University of Ottawa
- 75 Physics
- 76 Architecture
- 77 Architecture
- 78 Architecture
- 82 Civil Engineering
- 83 Civil Engineering
(*joint program*): offered at University of Ottawa
- 88 Mechanical and Aerospace Engineering
- 89 Mechanical and Aeronautical Engineering
(*joint program*): offered at University of Ottawa
- 92 Electrical Engineering
(*joint program*): offered at University of Ottawa
- 93 Information and Systems Science
- 94 Systems and Computer Engineering
- 95 Computer Science
- 97 Electronics

Course Numbering Pattern

The course numbering pattern is, in general, as follows:

001-099

Courses usually taken in Qualifying University year

100-199

Courses usually taken in First year

200-299

Courses usually taken in Second year

300-399

Courses usually taken in Third year

400-499

Courses ordinarily taken in Fourth-year Engineering, Fourth- and Fifth-year Architecture, and Fourth-year (Honours) Arts, Social Sciences, Science and Computer Science

500-599

Courses ordinarily taken by graduate students

600-699

Courses ordinarily taken by graduate students

General Regulations

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1. Administration of the Regulations

1.1 General Administration

The regulations on the following pages apply to all degree and diploma programs administered by the Faculty of Graduate Studies and Research.

1.2 Student Responsibility

(a) The student is responsible for knowing the regulations of the Faculty of Graduate Studies and Research and for complying with them. Any exceptions to the regulations must be approved, in writing, by the dean of the Faculty of Graduate Studies and Research. Routine approval of a records form (for example, a registration contract or a course change form) does not constitute approval of an exception.

It is also each student's responsibility to establish and maintain contact with his or her faculty adviser or thesis supervisor.

(b) In order for a student to receive his or her degree, he or she must fulfil:

1. all the requirements of the department, school or institute in which he or she is taking the degree;
2. all faculty regulations;
3. all University regulations;
4. all financial obligations to the University.

2. Admission Requirements and Eligibility

2.1 General Requirements

Graduates of recognized universities will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this calendar for details concerning the specific or additional requirements of each department, institute, or school.

2.2 Eligibility

A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:

- (a) The performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree
- (b) The capacity of the graduate department, institute, or school to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions
- (c) The availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

2.3 Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an honours degree, but have a pass degree with honours standing (at least B overall) will normally be admitted to a qualifying-year program.

If successful in this qualifying year, they may eventually proceed to the master's program. However, admission to the qualifying-year program does not imply automatic admission to the master's program. At the end of the qualifying-year program, the department will determine the student's eligibility to enter the master's program, and the student will be informed of this decision by the dean of the Faculty of Graduate Studies and Research.

Applicants for a master's degree who have a program requirement of 7½ full courses or more (with the exception of Social Work and Public Administration) will register initially in the qualifying-year program.

Courses taken to fulfill the requirements of the qualifying-year program may not be used for credit for the master's degree. Courses taken extra to the program requirements of the qualifying year and which have been successfully completed, may be considered for credit towards the master's degree.

2.4 Master's Program

For admission to the master's program, applicants must hold an honours bachelor's degree, or the equivalent, with at least high honours standing (normally B+ or better in honours subject; B- or better overall). The applicant must also be recommended by the department in which he/she plans to undertake his/her studies.

Applicants for a master's degree who have a program requirement of seven full courses or less will register directly in the master's program.

2.5 Doctoral Program

For admission to the Ph.D. program, applicants must ordinarily hold a master's degree (or equivalent) from a recognized university, normally with a minimum average of B+ in courses (including thesis where applicable), and normally with no grade below B-.

2.6 Restriction on Degrees

Applicants should note that of the bachelor's, master's, and Ph.D. degrees, only two may ordinarily be taken at Carleton University.

3. Application for Admission

3.1 Application Forms

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms, available from the major department or the Graduate Studies and Research Office, and they should be submitted directly to the department. To cover administrative costs, a non-refundable charge of \$10 is required with each application.

3.2 Deadlines

Candidates whose documents originate outside Canada must apply by June 1. All other applications must be received no later than July 1. Applicants should note that in many academic units application before July 1st is advisable.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications for admission by March 1 (except in the case of the School of Social Work and the Department of Psychology who require completed applications to be submitted before February 1).

Students applying to joint programs with the University of Ottawa should note that application procedures, especially deadlines, are different in the two institutions, and they should refer to the university calendars for details.

3.3 Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chair of the department concerned.

3.4 Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied, who are in a position to assess his/her potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of an applicant working in a research laboratory environment. All letters of reference are to be sent by the referees directly to the chair of the department.

3.5 Proficiency in English

Proficiency in English usage is considered necessary to pursue graduate studies at Carleton University. All applicants whose native tongue is not English must be tested for proficiency in the English language, and obtain a minimum score of 550. Tests are administered by TOEFL, Box 899, Princeton, N.J. 08540, U.S.A.

4. Admissions Procedure

4.1 General Procedure

All applications for admission will initially be examined and evaluated by the department, institute, or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration.

Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the dean of the Faculty of Graduate Studies and Research for consideration. The dean's office will officially notify each applicant whose admission is approved.

4.2 Admission Validity for New Students

The Statement of Standing on Admission issued to each newly-admitted student is valid only for the 12-month period stipulated on the form. If the applicant fails to register within this period of time, his/her admission and registration eligibility will lapse automatically. He/she may re-apply for admission.

4.3 Revocation of Admission or Registration

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has in the process provided false or incomplete information.

5. Program Requirements

5.1 General Information

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental program descriptions and details of courses section of this calendar. Prospective applicants should note particularly the admission requirements, the fields in which advanced study and research may be undertaken, and the program requirements of each department, in addition to the general regulations of the Faculty of Graduate Studies and Research, which are spelled out in this section.

5.2 Qualifying-Year Program

Students in the qualifying-year will ordinarily register in five full courses (or the equivalent) at the senior undergraduate level. Of these five, normally no more than one course at the 200 level and no more than two at the 500 level may be taken.

5.3 Master's Program

The normal requirement for the master's degree is five full courses, or the equivalent, of which at least four (including the thesis where applicable) must be at the

500 level. With departmental approval, the remaining one course may be selected from those offered at the senior undergraduate level, that is, at the 400 level.

5.4 Doctoral Program

The period of formal study and research required in the Ph.D. program will normally be at least two years of full-time study (or the equivalent) beyond the master's level.

The thesis will ordinarily carry a weight of about half of the total requirement of 10 full courses or the equivalent.

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500 or 600 level.

5.5 Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by departments according to their regulations and the needs of their students. Language requirements must be completed within the time limit allowed for the completion of the student's program.

6. Transfer of Credit

6.1 Transfer of Credit on Admission

Graduate courses completed at another institution or at Carleton University may be accepted in partial fulfillment of Carleton's degree requirements.

Credit for such work will be determined in each case by the Faculty of Graduate Studies and Research, on the recommendation of the department concerned. Master's candidates are allowed a maximum of two transferred full-course credits. In addition, if a master's candidate is granted transfer credit for two full courses, his/her remaining three courses at Carleton must be at the 500 level.

Doctoral candidates may be given up to one year's credit for work completed at other universities, but must normally register for a minimum of one year of full-time studies thereafter at Carleton, and fulfil the thesis and comprehensive examination requirements. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

A candidate who has completed courses as a special student is not normally permitted to transfer such courses for degree credit in the Faculty of Graduate Studies and Research.

Special students enrolled in a graduate level course are subject to Special Student regulations outlined in the undergraduate calendar.

6.2 Transfer of Credit After Admission

A student formally admitted, and eligible to register in a graduate program, is not permitted to register at Carleton University at the same time in any other graduate program or as an undergraduate or special student. Should he/she do so, credits may not be transferred.

Similarly if a student normally admitted to a graduate program at Carleton wishes to enrol in courses at another university, credit will be granted only if written permission is received from the dean of Graduate Studies and Research. Such permission must be received in advance of registration for the course work. *In no case will such transfer alter the maximum number of allowable transferred credits noted above.*

7. Registration and Course Selection

7.1 The Calendar Year

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the academic year (September-May) into two terms; each term comprises about 13 weeks of lectures or seminars. The first term of the academic year is designated as the *fall term* (registration period at the beginning of September); the second term of the academic year is designated as the *winter term* (registration period early in January), and the third term of the calendar year is designated as the *spring term* (registration period in late May). Graduate and senior undergraduate courses are also offered in the *summer session*, (registration period early in July) which comprises approximately six weeks of lectures or seminars. The precise dates of registration for the fall, winter, and spring terms, and for the summer session are specified in the academic schedule of this calendar.

All students enrolling at Carleton are required to register in their programs at designated times prior to the beginning of classes. They will initiate their registration procedures in their major department, from whom information concerning all phases of registration will be available.

7.2 Course/Program Approval

Graduate students must have *written approval* from their departmental supervisor of graduate studies for initial course/program registration, and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate-level course.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars, and is not entitled to thesis supervision, examination privileges, or access to research facilities. A student will receive no credit for

any work completed during a term in which he/she was not properly registered.

7.3 Revocation of Registration/Admission

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has in the process provided false or incomplete information.

7.4 Course Selection

A student proceeding to a graduate degree or diploma must arrange his/her program according to the regulations of the Faculty of Graduate Studies and Research and the major department.

The course and thesis requirements of each graduate program are organized or defined in units of full-course credits. A full-course credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. A half-course credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

7.5 Evaluation

To gain standing in a course, a student must meet the course requirements for attendance, term work, and examinations.

Instructors will inform their classes by distributing written notices before the last day for late registration of the elements that will contribute to the final grade and their weighting, including attendance, class participation, essays, tests, laboratories or studio-workshops, or other course-related work assignments, and final examinations.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research.

7.6 Tutorials

These are arranged to allow students to take full advantage of all the resources of the University, even in areas or fields of a very highly specialized nature. Such arrangements are subject to the approval of the supervisor of graduate studies, who will arrange that a document spelling out the details of the topic, reading list, etc., is submitted to the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

7.7 Audit Courses

Graduate students may register to audit *one full course per program*.

(a) Full-time students will not be charged an additional fee; others must pay the prevailing fee for part-time students.

(b) Part-time students will not be permitted to audit a course in addition to two half courses for credit per term.

7.8 Course Numbering System

Each course is identified by a seven-symbol code. The first two digits indicate the department, school, or committee under whose auspices the course is offered; the three digits following the decimal point identify the specific course; the letter which follows the course number designates the term in which the course is offered; for example, F: fall term, W: winter term, S: spring term, and T: two terms (fall and winter). The number which follows the letter indicates the credit weight of the course: 1 denotes one half-course credit, 2 denotes one full-course credit, etc.

7.9 Full-Time Course Load

A full-time graduate student will normally register in a minimum of three half-courses (or the equivalent) per term. An audit is not permitted as part of the three half-courses required per term to maintain full-time status.

7.10 Part-Time Course Load

Part-time students are permitted to enrol in a maximum of two half-courses per term including audit courses.

7.11 Status

All students are reminded that status is established only by formal registration in the appropriate courses for each term of activity in the calendar year.

Whether a student registers on a full- or part-time basis in the thesis, research essay, or independent research project is determined by the amount of time devoted to graduate studies and research, and the demands on university personnel, resources, and facilities.

7.12 Definition of Full-time Study

In addition to the *course load* requirements described above, the following criteria for full-time status have been established by the Ontario Ministry of Colleges and Universities:

(a) Students must identify themselves as full-time students; that is, they must so register during each term of activity.

(b) Students must be geographically available and visit the campus regularly; they may not be absent from campus without permission for a period exceeding four weeks in any term. Students wishing to undertake full-time studies off campus must secure, in advance, the written permission of the departmental chair and the dean of the Faculty of Graduate Studies and Research. (See Off-Campus Research).

(c) A full-time graduate student may not be regularly employed on work not directly related to his/her program for more than an average of 10 hours per week during any period of full-time registration.

7.13 Off-Campus Research

In the interest of enriching their learning experience, graduate students may arrange to undertake full-time studies or research at another institution, or in the field. It should be understood that such activity would apply to only a part of the total program, and that the off-campus period would not normally exceed 12 months.

Requests for permission to undertake full-time off-campus study or research must be submitted, well in advance, to the dean of the Faculty of Graduate Studies and Research, through the department concerned. Such requests should include the following information:

- (a) A detailed statement of the research proposal or program of studies, and the specific arrangements that are proposed for the supervision and direction of the work
- (b) An explanation of the reasons why the work cannot be satisfactorily undertaken while on campus at Carleton
- (c) A description of the studies and/or research facilities that are available at the proposed off-campus location
- (d) A written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution, confirming that the proposed arrangements are satisfactory, and that the candidate will be able to undertake research or studies
- (e) A time schedule for the proposed studies or research work
- (f) A statement of the candidate's expected sources of financial support.

7.14 Inter-University Co-operation in Graduate Instruction

Under certain circumstances, it is permissible for a student admitted to a graduate degree program, and registered at one Ontario university, to follow an approved credit course at another university. All interested students should consult the chair of their department, prior to registration, in order to obtain further information on procedures and conditions of eligibility. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the Graduate Studies Registrar's office.

7.15 University of Ottawa

Carleton University and the University of Ottawa have developed a number of joint programs at the graduate level. The details of these are given under the appropriate academic unit later in this calendar.

Where formal joint programs do not exist, a graduate student may be permitted to follow *up to two full courses* at the University of Ottawa. Moreover, there are reciprocal arrangements worked out among departments, institutes, and schools at both universities

to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chair of their department, institute, or school, prior to registration, in order to obtain further information on particular departmental conditions of eligibility and procedures. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the Graduate Studies Registrar's office.

8. Continuous Registration

8.1 Loss of Status

Any candidate who remains unregistered in his/her degree program for three terms (12 months) will lose his/her graduate status.

8.2 Continuous Registration in Thesis, Research Essay, or Independent Research Project

Any candidate (full-time or part-time), after initial registration in a thesis, research essay, or independent research project, must maintain this registration in all successive terms (including the term in which the student is examined), until his/her thesis, research essay, or independent research project is completed. Completion means modifications, any retyping involved, etc. Students should note that faculty approval to register in the thesis, etc., is given on the understanding that the student will be in regular contact with his/her supervisor, and that thesis research will be actively pursued in each term of registration.

8.3 Deposit of Thesis Copies

In the case of a thesis, registration must be maintained until five final copies are deposited in the Graduate Studies and Research Office. Should the final copies not be deposited in the Graduate Studies and Research Office by the last day for late registration in a given term, the student will be required to register for that term.

8.4 Thesis Registration by Mail

Registration by mail is acceptable for part-time students in theses, etc., provided that the prescribed form is completed and returned (through the department concerned) together with fee payment (cheque or money order) before the last date for course changes in each term.

8.5 Reinstatement

Students whose files have been closed as a result of failure to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated, students must pay a reinstatement charge which consists of \$25.00 plus the

current minimum tuition fee for each term in which they failed to register.

The reinstatement charge is a tuition fee and therefore, is defined as eligible for income tax deduction.

8.6 Exemption from Registration

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

(a) Writing to the dean of the Faculty of Graduate Studies and Research stating the reasons for seeking exemption from registration

(b) Requesting a statement from the departmental supervisor of graduate studies (and from their thesis supervisor, if there is one) in support of their request, confirming that they will not be on campus for the term, will not use any University facilities (that is, library, laboratories, computer centre, etc.), or receive any supervision, including supervision through correspondence.

It is understood that such an exemption from registration will be granted only in exceptional cases (for example, medical or other special reasons).

Exemptions are normally granted for one term, but in extraordinary circumstances an exemption may be granted for a longer period.

When exemption from registration for a term or terms has been approved by the dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program.

8.7 Off-Campus Registration

Students who have been permitted to study off campus, while registered full-time at Carleton, may register by mail. Registration forms may be obtained from the Graduate Studies and Research Office upon request.

8.8 Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. This is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be made on prescribed course change forms, which are available at the departmental offices or at the Graduate Studies and Research Office.

Note: The deadline dates for course changes are stipulated in the academic schedule of this calendar.

8.9 Withdrawal

A graduate student wishing to terminate his/her registration in a graduate program (that is, drop all courses) must complete the prescribed withdrawal form available in the department or in the Graduate Studies Registrar's office (or in writing the department concerned) and return his/her identity card.

(a) Withdrawal Credit

When a student officially withdraws, at the office of the dean of the Faculty of Graduate Studies and Research, a withdrawal credit will be calculated on a pro rata basis as of the date of receipt of the withdrawal form (or letter). Credit for fees or refunds will depend on the date of withdrawal and the amount of fees originally paid. Students are encouraged to examine the financial implications of withdrawal. A detailed refund schedule is available at the office of the dean of Graduate Studies and Research. (See Withdrawal and Fee Credit, page 28).

(b) Mid-Term Transfer of Program

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or special student status. Any candidate who elects to change programs after registration (*before* the last day of late registration) will be required to withdraw from the first program and then register in the second. The pro rata refund of fees calculated as a result of withdrawal from the first program can be applied against the new fee assessment for the second program.

(c) Degree/Diploma Completion

A registered candidate who completes his/her degree or diploma requirements prior to the last day for withdrawal in any term (as specified in the academic schedule) is required to withdraw formally if he/she anticipates any refund of fees. A candidate whose degree program has been completed is not eligible for further registration in the Faculty of Graduate Studies and Research (unless he/she has been admitted to some other graduate program).

9. Examinations

9.1 General Remarks

Final examinations in courses will be held at the times indicated in the academic schedule. Graduate students must obtain grades that meet the standards outlined in the academic standing section of this calendar, and that satisfy the specific requirements of the department concerned.

9.2 Supplemental and/or Grade-Raising Examinations

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research. Graduate students may, however, with the permission of their department, repeat a course at the time of next regular offering to obtain higher standing.

9.3 Special/Deferred Final Examinations

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his/her control, or whose performance on the examination has been impaired by such circumstances, may apply to write a special or deferred final examination. Such an application will be considered only if it is submitted in writing to the dean of Graduate Studies and Research within *two* weeks of the examination.

If the student has been seen at the University Health Services, the dean's office will confirm the illness by contacting the treating physician. If the student has consulted a physician outside the University, he/she will be required to submit a statement (from the physician) confirming the illness.

In cases other than illness, appropriate documents will be required.

9.4 Master's Examinations and Deadlines

In addition to any examination which may be required in individual courses, a master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his field of specialization, or both. The thesis must be submitted, in examinable form, at least two weeks in advance of the thesis examination. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the calendar entry for their department.

9.5 Doctoral Examinations and Deadlines

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton.

A comprehensive examination, covering prescribed fields, will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and accepted for examination, a final oral examination on the subject of the thesis and related fields will be held. Such thesis examinations will be scheduled upon receipt of theses, which must be submitted at least four weeks in advance of the date of the examination.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the calendar entry for their department.

9.6 Comprehensive and Thesis Examinations

The date, place, and time of comprehensive or thesis examinations will be announced at least two weeks in advance. An examining board will be appointed according to the guidelines laid down by the Faculty of Graduate Studies and Research.

9.7 Unsatisfactory Grades

If the comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the comprehensive examination is graded unsatisfactory for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Faculty of Graduate Studies and Research.

The comprehensive and thesis examination processes must be conducted according to the principles and practices prescribed by the Faculty of Graduate Studies and Research.

Note: Copies of the "Thesis Guidelines" manual are available in the departments or in the Faculty of Graduate Studies and Research office.

10. Grading System

10.1 Letter Grades

Carleton University employs the 12-point system of letter grades to represent standing in graduate lecture courses, directed studies, seminars, tutorials, and some research essays and theses. The letter grades used, and the grade point equivalents, are as follows:

A+	12	B+	9
A	11	B	8
A-	10	B-	7
C+	6	D+	3
C	5	D	2
C-	4	D-	1

10.2 Other Grading Notations

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

(a) A notation of *Satisfactory* or *Unsatisfactory* may be assigned, subject to the approval of the Faculty of Graduate Studies and Research, in certain very special courses involving practicum, field work, or other complex activities not easily adaptable to the 12-point system of grading.

(b) Comprehensive examinations are graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*.

(c) The master's thesis is graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*, or it may be assigned a letter grade. The oral defence is graded *Satisfactory* or *Unsatisfactory*.

(d) The Ph.D. thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*.

(e) A notation of *Incomplete* may, subject to the approval of the chair of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases, (for example, medical or other special reasons) and must be replaced with a letter grade within 40 days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change-of-grade procedures) within 40 days of the end of classes, the notation will remain as a permanent entry for that registration in the course. However, the student may register to repeat the course in order to obtain letter grade credit.

(f) A notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his/her absence (in writing) to the dean of the Faculty of Graduate Studies and Research within 14 days of that examination, he/she may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes; this notation is deemed to be the equivalent of a failure.

(g) If a thesis, research essay, or independent research project is not completed by the end of the period of registration, the notation of *In Progress* will be recorded. The notation *In Progress* may, subject to the approval of the Faculty of Graduate Studies and Research, be used for a research seminar, i.e. a seminar in which students present the results of their thesis research. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis, research essay, independent research project or research seminar has been examined. In cases where a student has registered in a research essay or a thesis, without completing it, and later undertakes course work to complete the degree program — or loses graduate student status in his/her program — the notation *In Progress* will be changed to *Incomplete*.

10.3 Release of Grades

A Statement of Marks is mailed to each student as soon as the grades are available after the end of the fall and winter terms of the Fall/Winter session and after the end of the Spring session. Students may obtain a copy of their official transcript by completing a copy of the "Request for Academic Transcript" form which is available in the Faculty of Graduate Studies and Research. Transcripts required for professional and graduate schools should be ordered well in advance of

any deadline set by these institutions. Students are advised that no Statement of Marks or official transcripts will be released by the University until all outstanding accounts due have been paid. (See Delinquent Accounts page 28).

11. Academic Standing

11.1 Qualifying-Year Program

Students should note that admission to the master's program from qualifying year is governed by the admission requirements for the master's program outlined on page 12 of this calendar.

11.2 Master's Program

A grade of B- or better must normally be obtained in each course credited towards the master's degree.

A candidate may, with the recommendation of his/her department, and the approval of the dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half-courses. Some departments do not permit the C+ option; students should check carefully to see if the department in question has a B- minimum rule.

(a) Full-Time Continuation

Full-time master's candidates who fail to achieve a weighted grade point average of 7.0 after two terms of study, or to maintain it subsequently, will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the dean of the Faculty of Graduate Studies and Research for permission to continue in the program.

(b) Part-Time Continuation

A part-time master's student who fails to achieve or maintain a weighted grade point average of 7.0 after completing two full courses (or equivalent) will be required to withdraw from the program.

11.3 Doctoral Program

Doctoral students must normally obtain a grade of B- or better in each course credited towards the degree.

11.4 Departmental Evaluations

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfac-

tory. In the event that progress is deemed unsatisfactory, the Department may recommend to the dean of the Faculty of Graduate Studies and Research that the student be required to withdraw.

12. Thesis Requirements

12.1 General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one-half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form, consistent with the discipline concerned, and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

A candidate will not be permitted to submit a thesis for which he or she has previously received a degree; however, with the permission of the dean of the Faculty of Graduate Studies and Research, he or she may incorporate into the thesis material that was included in a previous thesis.

12.2 Master's Thesis

The master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in an organized and systematic way.

(a) Oral Examinations

Candidates are ordinarily required to undertake an oral examination of the thesis. Notice of this examination will be given at least two weeks in advance by the chair of the department.

The master's thesis will be examined by a board consisting of at least four members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate and one additional member from the department concerned.

The constitution of the examining board will be announced by the chair of the department concerned; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

(b) Thesis Weight

Thesis weight (one to three full courses) must be identified at the time of admission. A change in the thesis weight at a later date would require the approval of the dean of the Faculty of Graduate Studies and Research.

(c) Research Essays and Independent Research Projects

Faculty regulations governing research essays and independent research projects are normally the same as those for a master's thesis, and subject to the guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

12.3 Doctoral Thesis

The doctoral dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his/her findings in an appropriate manner.

(a) Oral Examinations

The dissertation must be defended successfully at an oral examination. Notice of this examination will be given at least four weeks in advance by the dean of the Faculty of Graduate Studies and Research.

The doctoral dissertation will be examined by a board consisting of at least five members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority on the subject of the thesis.

The constitution of the examining board will be announced by the dean of the Faculty of Graduate Studies and Research; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

(b) Thesis Weight

Thesis weight (ordinarily about half of the total Ph.D. requirement of 10 full courses) must be identified at the time of admission. If the thesis weight falls within a range of credit weights, it should be assigned at the time of admission a weight corresponding to the lower bounds of that range. A change in the thesis weight at a later date would require the approval of the dean of the Faculty of Graduate Studies and Research.

The work of each Ph.D. candidate will be assisted by an advisory committee of faculty members, who will aid him/her in his/her preparation for the final comprehensive examination, and assist in the evaluation of the thesis and oral examinations.

12.4 Deadlines

(a) Master's Thesis

A master's student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *March 1*. A master's student expecting to graduate at the Fall Convocation must submit his/her thesis by *August 1*. A master's student expecting to graduate at the Winter Graduation must submit his/her thesis by *December 1*.

(b) Doctoral Dissertation

A Ph.D. student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *March 1*. A Ph.D. student expecting to graduate at the Fall Convocation must submit his/her thesis by *August 1*. A Ph.D. student expecting to graduate at the Winter Graduation must submit his/her thesis by *December 1*.

12.5 Specifications

(a) The candidate must submit *six* typewritten copies (original and five acceptable duplicated copies, on bond paper) and must comply with special departmental requirements governing the form of the thesis, including methods of bibliographical entry, and the use of diagrams and tables.

(b) Each thesis or dissertation must be accompanied by a suitable abstract. The abstract of a master's thesis should not exceed 150 words, while the abstract of a doctoral thesis may be up to 350 words in length.

(c) Regulations regarding style, pagination, certification, acceptance, grade and size of paper, as well as abstracts, reproduction, microfilming, binding, and the constitution of the examining board will be prescribed by the Faculty of Graduate Studies and Research.

(d) (i) Master's

The candidate is expected to notify his/her supervisor and the chair of the department at least two weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit six copies of the completed thesis to the department at least four weeks in advance of the intended date of examination.

The thesis examination and defence will then be scheduled and the date will be announced at least two weeks in advance. The department must deposit one copy of the thesis to the Graduate Studies and Research office at least two weeks in advance of the actual date for the examination and defence.

(ii) Doctoral

The candidate is expected to notify his/her supervisor and the chair of the department at least two weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit six copies of the completed thesis to the department at least six weeks in advance of the intended date of examination.

The thesis examination and defence will then be scheduled and the date will be announced at least two weeks in advance. The department must deposit one copy of the thesis to the Graduate Studies and Research office at least four weeks in advance of the actual date for the examination and defence.

(e) The five unbound copies of the approved thesis submitted to the faculty for binding should be the original and four others, and they must be presented in order of pagination in separate envelopes. Two copies are maintained in the library, the third copy is given to the department, the fourth copy is for the candidate, the fifth copy is for the thesis supervisor.

12.6 Licence to the University and to the National Library of Canada

In the interest of facilitating research by members of the Carleton community and by interested outsiders, and in consideration of his/her having been accepted as a graduate student at Carleton, the student author of a thesis or dissertation submitted in partial fulfilment of the requirements for an advanced degree, shall grant to the University and to the National Library of Canada a licence to make single copies or microfilms (solely for the purpose of private study and research, in response to written requests from individuals, libraries, universities, or similar institutions).

It is understood that the student author retains other publication rights, and that neither the thesis, nor the dissertation, nor extensive extracts from them, may be printed or otherwise reproduced without the author's written permission.

12.7 Withholding of Thesis Deposition

If, at the time of submitting his/her thesis, the student elects to protect any rights to immediate commercial publication, or to obtain a patent which may arise from his/her research, or to keep his/her thesis out of circulation for other reasons, he/she may apply in writing to the dean of the Faculty of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

(a) For an initial period of three months without reason

(b) For each additional period of six months, with reason (total period of restriction not to exceed two years).

The student must submit any request for extension of the restriction one month prior to the termination of the previous period. The student and his/her supervisor will be required to justify the extension of the restriction. Subsequent requests must follow the same procedure.

13. Time Limits for Program Completion

13.1 General Remarks

There are maximum time limits for the completion of programs. Candidates may also be subject to time constraints prescribed by individual departments to ensure orderly progress through the stages of their programs.

13.2 Master's Program

(a) *Full-time*

Full-time master's candidates must complete their degree requirements within six terms of registered full-time study. Students admitted to a 10-course master's program (that is, in the School of Public Administration and the School of Social Work) must complete their degree requirements within nine terms of registered full-time study.

(b) *Part-time*

A part-time master's candidate must complete his/her degree requirements within an elapsed period of six calendar years after the date of initial registration. Students admitted to a 10-course master's program (that is, in the School of Public Administration and the School of Social Work) must complete their degree requirements within an elapsed period of eight calendar years after the date of initial registration.

(c) *Combined Full-time and Part-time*

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study is governed by the following elapsed-time limitation: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered four or five terms as a full-time student and part-time for the balance.

These limitations are calculated from the date of initial registration in the master's program.

(d) *Combined Full-time and Part-time*

(10-course Master's Program /- School of Public Administration and School of Social Work)

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of initial registration in the master's program.

13.3 Doctoral Program

(a) *Full-time*

A full-time Ph.D. candidate who is admitted on the basis of a master's degree (that is, with a program of 10 full courses or the equivalent) must complete the Ph.D. degree requirements within an elapsed period of six calendar years after the date of initial Ph.D. registration.

(b) *Part-time*

A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of initial registration in the Ph.D. program.

13.4 Exemption from Time Limit

When exemption from registration for a term or terms has been approved by the dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program.

13.5 Extension of Time Limit

In exceptional cases, an extension of time permitting further registration (one or two terms) may be granted to a candidate whose recent progress, as judged by the department, has been otherwise satisfactory. Requests for extension of time should be directed to the dean of the Faculty of Graduate Studies and Research through the department concerned.

13.6 Grade Review

Within two weeks of the release of grades or the announcement of comprehensive examination results or thesis results, a graduate student may request, through the dean of the Faculty of Graduate Studies and Research, that one or more of his/her grades or results be reviewed. The charge for such a review is \$25, which is refundable if the grade is raised.

13.7 Program Review

A graduate student has the right to request a review of decisions made concerning his/her graduate status or any other ruling relating to his/her program. All such requests are to be made in writing to the dean of the Faculty of Graduate Studies and Research.

14. Instructional Offences

14.1 Regulations

The Senate of the University has enacted the following regulations for instructional offences at the graduate level:

Any student commits an instructional offence who:

(a) cheats on an examination, test, or graded assignment by obtaining or producing an answer by deceit, fraud or trickery, or by some act contrary to the rules of the examination;

(b) submits substantially the same piece of written work to two different courses. Minor modifications and amendments or changes of phraseology do not constitute a significant and acceptable reworking of an essay or paper;

(c) contravenes the regulations published at an examination or which are displayed on the reverse side of a properly authorized examination booklet;

(d) commits an act of plagiarism. Plagiarism will be deemed to have occurred when a student either:

- (i) directly copies another's work without acknowledgement; or
- (ii) closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or
- (iii) borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as the student's own thought, where such ideas, if they were the student's own, would contribute to the merit of his or her own work;

(e) disrupts a class or other period of instruction if he or she:

- (i) is a registered member of the class or period of instruction;
- (ii) is warned to discontinue any act or behaviour reasonably judged by the instructor of the course or period of instruction to be detrimental to the class, and having ignored such warning is ordered by the instructor to leave and refuses to leave.

(f) Any student found in violation of these regulations may be:

- (i) expelled;
- (ii) suspended from all studies at the University;
- (iii) suspended from full-time studies;

and/or

- (iv) awarded a reprimand;
- (v) refused permission to continue or to register in a specific degree program but subject to having met all academic requirements shall be permitted to register and continue in some other program;
- (vi) placed on academic probation;
- (vii) awarded a *Fail*, or *Abs* in a course or examination.

Allegations of instructional offence may be investigated by instructors and/or departmental chairs and, in all cases, will be reported to the faculty Dean. The Dean will promptly advise, in writing, the student and the University Ombudsman of the allegation and of the student's rights. The Dean will review the allegation and, if not resolved at that level, the allegation becomes subject to final disposition by a tribunal appointed by the Senate. Information about procedure governing tribunals is available from the Clerk of the Senate, room 607, Administration Building.

15. Appeals and Petitions

15.1 Criteria and Procedures

A graduate student may appeal the decision of the University to deny the award of degree or the required withdrawal of the student to the Senate upon certain specific grounds.

Such grounds are the allegation by the student that the student has been denied a degree or forced to withdraw because of some mistake, error or improper conduct by the University, its officers or employees.

A graduate student may petition the Senate to grant a degree or to stay a decision of required withdrawal on compassionate grounds.

Such appeals and petitions must be submitted in writing, within ninety days of receipt by the student of the decision which is to be appealed or petitioned, to the Clerk of the Senate, room 607, Administration Building.

16. Graduation

16.1 Conferring of Degrees

On the recommendation of the Faculty of Graduate Studies and Research, and with the approval of the Senate of the University, degrees are conferred by the chancellor in the spring and fall of each year.

16.2 Application Deadlines

Candidates may have their degrees certified in February each year; they must apply by *December 1*. Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies and Research Office by *February 1*. Those expecting to graduate at the Fall Convocation must apply by *September 1*.

General Information

Hours of Operation

Bookstore

Labour Day to May

Monday to Thursday 9:00 A.M. — 9:00 P.M.

Friday 9:00 A.M. — 4:30 P.M.

There will be no refunds or exchanges without the Bookstore cash register receipt. Refer to the Bookstore refund/exchange policy, located in the store, for further details.

Business Office

Monday to Friday 9:00 A.M. — 4:00 P.M.

Evening Service

Monday and Thursday 5:00 P.M. — 7:00 P.M.

Library

Summer Session

Monday to Thursday 8:30 A.M. — 11:00 P.M.

Friday 8:30 A.M. — 6:00 P.M.

Saturday 10:00 A.M. — 5:00 P.M.

(5:00 P.M. — 11:00 P.M.)*

Sunday 1:00 P.M. — 5:00 P.M.*

(5:00 P.M. — 11:00 P.M.)*

*Hours are extended before exams begin in August.

Winter Session

Monday to Friday 8:00 A.M. — 11:00 P.M.

Saturday 10:00 A.M. — 10:00 P.M.*

Sunday 12:00 noon — 10:00 P.M.*

*Week-end hours are extended to 11:00 P.M. during periods of heavy use.

When classes are not in session hours vary and are posted at the entrance.

Alumni Association

Originally founded in 1949, the Carleton University Alumni Association today represents the more than 45,000 graduates of Carleton University and the former St. Patrick's College. The goals of the Association are: a) to advance the excellence and prestige of Carleton University as a distinguished institution of higher learning in Canada; and b) to encourage a spirit of loyalty, friendship, service and benevolence among the members.

The Alumni Association sponsors an annual Alumni Weekend on the last weekend of September; reunion and branch programs; speakers' series; the Careers Insight program; and the A.D. Dunton

Alumni Award. As well, alumni support the University through personal and corporate contributions.

On behalf of the Association, the University maintains business and home addresses for the graduates, publishes Carleton University Magazine, and provides administrative and executive support for the Alumni Council. Benefits extended by the University to alumni also include library privileges, membership in the Faculty Club, a reduced rate in the annual fee for the Fitness and Recreation Centre and a group term life insurance program.

For information about the Alumni Association and any of its programs, call or write, Development and Alumni Services, Carleton University, Ottawa, Ontario, K1S 5B6, telephone (613) 788-3636.

Athletics and Recreation

The athletics and physical recreation program at Carleton, which plays an important role in maintaining and enhancing University spirit, is determined by the policies established by the Athletics Board, a committee consisting of students, faculty members and administrators. The Board advises the University on matters of athletics and recreation policy through the Office of the President.

At the interuniversity level, Carleton is a member of both the Ontario Universities Athletic Association (for men) and the Ontario Women's Intercollegiate Athletic Association. Varsity programs for men include basketball, football, cross-country skiing, waterpolo, rugby, swimming, fencing and soccer. The women's teams participate in basketball, volleyball, cross-country skiing, waterpolo, field hockey, swimming, fencing and soccer. Graduate students are eligible for interuniversity athletics, subject to league regulations.

The intramural program includes touch football, cross-country running, basketball, badminton, swimming, curling, squash, team handball, and hockey. Some of these sports are co-educational.

Carleton's athletics facilities include football and soccer fields, five tennis courts, a 50-metre swimming pool, fitness centre, and a gymnasium complex, which includes such facilities as squash courts, combatives room, multipurpose room, and a gymnasium. These facilities are available for use by Carleton students for organized and recreational sports activities.

Chaplaincy

For the past 20 years there has existed at Carleton a chaplaincy service, part of whose function has been to share experiences, insights, friendship, and faith. It has also been involved in study and discussion groups, community projects, development education, marriage preparation, and religious services. The chaplaincy service also has connections with many organizations and resources on campus, as well as with churches and religious groups in the Ottawa area.

The two principal chaplains are the Reverend Neil Hunter (Protestant-Ecumenical), who is located in T28 and T30 Tory Tunnel, and can be reached at 788-4449, and Father Michael Peterkin (Roman Catholic), who can be reached at 237-5616 or 788-2896 in room 127G Unicentre. People are encouraged to visit at any time. Appointments are not necessary, but at times they are advisable and can be arranged by the support staff in the chaplaincy offices.

There is a Quiet Room next to the chaplaincy offices in the Tory Tunnel which is used for individual meditation, religious services, and study-group activity. It is open all day, five days a week. In addition, Father Peterkin exercises a ministry at Newman House, 1061 Bronson Place, that is open to all as a house of hospitality and welcome, and that can also accommodate smaller groups who wish to meet there.

Computing and Communications Services

Computing and Communications Services

Room 401, Administration Building

Telephone 788-3700

Carleton University offers a wide range of computer services to its students. In addition to the main computing system, a Honeywell DPS8/49 triple processor under the CP-6 operating system, there are eight microcomputer networks used for instruction. As well, many departments have their own mini- and micro-computer systems applied to current research work.

Comprehensive data analysis packages such as SPSS and BMDP, and the NAG mathematical library, are available for general research applications. Several easily-used plotting programs have been developed to facilitate the use of graphics. The Supervisor of User Services can provide information on available programs. A "Directory of Services" is available, summarizing the facilities and services offered.

Counselling Services

The University Counselling Services is an educational resource centre available to all members of the University community. A qualified team of counselling professionals offers the wide range of services and programs listed below.

All contacts with Counselling Services are voluntary and strictly confidential. Information is only released upon the request and consent of the client involved.

Other types of assistance include appropriate on- and off-campus referrals when required, and consultation regarding the problems of another person.

The centre is located in Room 501 of the Unicentre, with office hours from 9:00 A.M. to noon and from 1:00 P.M. to 5:00 P.M. Further information about services and programs may be obtained from the centre in person, or by telephone at 788-6600.

• Counselling Services

Personal counselling assists people in dealing more effectively with emotional and social concerns. Educational and career counselling involves learning to plan wisely, handle difficulties, and make decisions with regard to academic and vocational concerns. Individual and group approaches are used in providing counselling and therapy.

• Testing Service

A testing program is designed in consultation with a counsellor, and constitutes an individual assessment according to the type of self-knowledge required. Relevant information generated by interest, personality, ability, and test results is used in helping to determine goals and make choices.

• Information Services

A resource centre is maintained for use in educational and vocational planning. It includes materials on occupations, university and community college calendars, directories, and other types of career literature. Information regarding other sources of assistance at Carleton and in the greater Ottawa community is also available.

• Learning Assistance Service

Various programs and activities are designed to create learning experiences which further the development of effective reading and study skills. Testing, instruction, and practice are provided to correct difficulties, and to improve the ability to learn and study. Individual and group approaches are utilized.

• Campus Life Orientation

The program provides direct and indirect service to students at the university. Its main goal is to assist new students in a variety of areas (e.g. academic, social, emotional, etc.) thereby easing the transition to life at Carleton. In addition to initial activities, services and programs are offered throughout the year.

• Foreign Student Advisory Service

Counselling concerning any difficulties which a foreign student may experience while at Carleton is available through this service. Student assistance is provided for academic and non-academic difficulties, financial concerns, health and immigration regulations, and adaptation problems. The Foreign Student Advisory Service may be reached at 788-6602.

• Group Programs

These afford opportunities to be involved in a variety of experiences in which learning is best facilitated through group participation. They are offered periodically throughout the year. The nature and content of programs are publicized, along with dates and registration details.

• Program for the Disabled

The office of the co-ordinator of the Program of the Disabled offers information, counselling, advocacy or assistance with a variety of practical issues to members of the Carleton community of any disability (mobility impaired, deaf and hearing-impaired, blind and visually-impaired, learning disabled and other hidden disability groups often not recognized). For a complete list of services please see the annual "Accessibility and Resource Guide" and/or contact the co-ordinator in Room 500 University, Centre, 788-6608.

Day Care Centre

The Colonel By Child Care Centre at Carleton operates in two locations on campus, Renfrew House residence and the Loeb Building. The centre is open all year except for statutory holidays, and the hours are from 8:00 A.M. to 5:45 P.M., five days a week.

Currently, the ages of children in the centre are six months to five years.

Inquiries should be addressed to Sandra Thompson at 788-7483 (for children six months to two and one-half years) and Margot Saunders at 788-2715 (for children two and one-half years to five years).

There is currently an extensive waiting list in both programs. The average length of time before admittance is 12-18 months. Please register well in advance.

Fees

Fees at Carleton are calculated on a composite basis to include tuition, the Students' Association and the Graduate Students' Association, Athletics, University Centre, and Health Services fees.

The University reserves the right to change all fees, charges, and refund policies without notice. The fee schedule published below was in effect for the academic year 1988-89 and is subject to change.

Canadian Citizens and Landed Immigrants

• Full-Time

Master's Program and Diploma in Public Administration

*(first year of full-time study)

Tuition	\$709.00
Student Sickness/Accident Insurance†;	19.00
Students' Association	30.25
Athletics	48.48
Health	12.92
University Centre	10.00
Challenge Fund	5.00

Total composite fee (per term) **\$834.65****

*First and second year of full-time study for students in Public Administration and Social Work.

†The student sickness/accident insurance coverage is based on a one-year period from October 1 to September 30. The insurance fee is payable once a year at registration. Therefore, students who register in September will receive twelve months' coverage and pay only when registering in September. Students who register in January for their first term will receive eight months' coverage and pay at registration. Students registering solely for the summer term will not receive coverage; however, those summer students previously registered in the fall or winter terms will continue to receive coverage over the summer.

**This amount includes the compulsory insurance fee of \$19.00. For students registering in January for their first term, this fee is \$12.65; therefore, the total composite fee for that term is the amount shown less \$6.35. For students registering in May for their first term, there is no insurance coverage; therefore, the total composite fee for that term is the amount shown less \$19.00.

The Carleton University Challenge Fund is the biggest fund-raising campaign in Carleton's history. In a referendum in March, 1987 Carleton University students voted in favour of an annual student donation for five years to support the Challenge Fund. The donation for full-time students is \$5.00 per term. The donation for part-time students is \$1.50 per term.

A donation receipt will be produced and distributed with the tuition receipt in February. Refunds for students who do not wish to support the Challenge Fund will be available following each registration at dates and times to be announced in the student newspaper, the Charlatan.

(second or subsequent year of full-time study)

Tuition	\$213.00
Student Sickness/Accident Insurance†	19.00
Students' Association	9.08
Athletics	14.55
Health	3.87
University Centre	3.00
Challenge Fund	5.00

Total composite fee (per term) **\$267.50****

Doctoral Program

(first and second year of full-time study;
third year of full-time study for students
in a 15-course Ph.D. program)

Tuition	\$709.00
Student Sickness/Accident Insurance†	19.00
Students' Association	30.25
Athletics	48.48
Health	12.92
University Centre	10.00
Challenge Fund	5.00
Total composite fee (per term)	\$834.65**

(third or subsequent year of
full-time study)

Tuition	\$213.00
Student Sickness/Accident Insurance†	19.00
Students' Association	9.08
Athletics	14.55
Health	3.87
University Centre	3.00
Challenge Fund	5.00
Total composite fee (per term)	\$267.50**

Qualifying Year

Arts, Journalism, and Science

Total composite fee (per academic year)	\$1,648.30**
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Engineering

Total composite fee (per academic year)	\$1,768.30**
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- Part-time

Tuition	\$213.00
Students' Association	9.08
Athletics	14.55
Health	3.87
University Centre	3.00
Challenge Fund	1.50

Total composite fee (per term)	\$245.00
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Foreign Students (In Program)

- Full-time

Doctoral Program

(first and second year of
full-time study; third year of
full-time study for students
in a 15-course Ph.D. program)

Total composite fee (per term)	\$1,596.65**
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(third or subsequent year of
full-time study)

Total composite fee (per term)	\$494.50**
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An "in program" student is a doctoral student who began a continuous master's/doctoral program before September 1982.

The "new registrant" fees apply to all other foreign students who are not exempt from the foreign student fee.

Foreign Students (New Registrants)

- Full-time

Master's Program and Diploma in Public Administration

*(first year of full-time study)

Total composite fee (per term)	\$3,378.65**
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(second or subsequent year of
full-time study)

Total composite fee (per term)	\$1030.50**
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Doctoral Program

(first and second year of
full-time study; third year of
full-time study for students in
a 15-course Ph.D. program)

Total composite fee (per term)	\$3,378.65**
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(third or subsequent year of
full-time study)

Total composite fee (per term)	\$1030.50**
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Qualifying Year

Arts, Journalism and Science

Total composite fee (per academic year)	\$5,559.30**
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Engineering

Total composite fee (per academic year)	\$8,912.30**
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- Part-time

Total composite fee (per term)	\$1008.00
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Exemptions for Foreign Students

Subject to the approval of the dean of Graduate Studies and Research, the following categories of foreign students are exempt from the foreign students' fee indicated above, and will instead be assessed the regular tuition fee:

- Persons, or dependents of persons, admitted to Canada under diplomatic visas — Immigration Act, Section 7(1)(A)
- Dependents, excluding the spouse, of a person admitted to Canada on a special visa to practise his or her special profession for a specified period of time — Immigration Act, Section 7(1)(H)
- Persons sponsored and financially assisted by agencies such as the Canadian International Development Agency, the International Development Research Centre, etc.

Persons studying under a reciprocal exchange agreement recognized by the Ministry of Colleges and Universities.

Persons who believe that they qualify for exemption under one of the foregoing categories must submit documentation, at the time of registration, to support their claim. University personnel will be available at that time to answer any queries.

Method of Fee Payment

Full-time and part-time fees are payable in full, by term. Winter term courses registered for in September

are payable on or before January 15.

Scholarships, bursaries, and loans administered by the University will be applied first to fees, provided that this is not contrary to the terms of the award.

Personal cheques will be accepted for the payment of accounts, but the University reserves the right to cancel this policy if it is abused. A service charge of \$9.50 will be assessed for each cheque returned to the University as non-negotiable for any reason. Students are requested to provide their own cheques when making payments.

A statement of tuition fees paid will be available for income tax purposes by the end of February and mailed to all students who have paid accounts in full. Students will be charged \$3.50 in advance for each duplicate tax certificate requested.

Delinquent Accounts

Registration will not be complete until a satisfactory arrangement has been made for the payment of fees, and it may be cancelled should the student fail to meet these arrangements.

If a student owes the University *any* money at the end of an academic session, his/her account becomes delinquent.

Students with delinquent accounts will not receive examination results, are not permitted to receive transcripts, *and will not be permitted to register again* until all monies have been paid in full by cash or certified cheque.

Withdrawal and Fee Credit

Students who are withdrawing from a course or courses, or entirely from the University, must notify the Office of the Dean of Graduate Studies and Research, either on the specific form designated for the purpose and available from that office, or by letter. The official date of withdrawal is the date on which the notification is received in the Graduate Studies and Research Office. Partial credit of fees for students withdrawing will also be calculated as of that date. No partial credit of fees is available unless all required procedures have been completed by the student on or before the appropriate designated last date for withdrawal.

A withdrawal credit of the composite fee less a registration charge of \$32.50 may be made for withdrawals before the last day for late registration. After the last day for late registration, the tuition portion of the composite fee, less the registration charge, is amortized over the period from the first day of classes to the last date for withdrawal with partial refund credit. Students who registered for the fall and winter terms during the fall registration period and who complete all winter term withdrawal requirements by the last date for fall term examinations will receive a credit of the full composite winter term fee.

A detailed schedule of withdrawal credits is available at the Graduate Studies and Research Office.

Miscellaneous fees are not refundable after the last day for late registration. Late registration fees are also not refundable.

The appropriate withdrawal credit will be applied to the student's account and any amounts due at that time will be offset before a refund is prepared.

Following are the last dates for withdrawal with partial credit of fees; application for withdrawal and credit may not be considered if received after these dates:

1988 Spring/Summer Term — July 28

1988 Fall Term — November 10

1989 Winter Term — March 16

Tuition Fees: Senior Citizens

All persons 60 years of age and over as of the last day for late registration may register in degree-credit courses and have their tuition fees waived. The charge to these students is a \$5.00 per session registration fee, plus the Challenge Fund contribution and Accident/-Sickness Insurance charge (applicable to full-time studies).

Other Charges

Late Registration Charge

The late registration charge is assessed according to the date registration is completed and is non-refundable.

Full-time Students - \$62.50

Part-time Students - \$12.50

Appeals

To cover administrative costs, the charge for each appeal is \$25, which is refundable if the appeal is successful.

Application

To cover administrative costs, a non-refundable charge of \$10 is required with each application.

Student Identification Cards

A charge of \$5.50 will be assessed for the replacement of student identification cards. Returning students will be requested to pay this amount at registration in the event that the student's card is not available for validation. The identification card remains the property of Carleton University and it may be cancelled or withheld at the discretion of the university.

Transcripts

Each student is eligible to receive one free transcript at graduation. All other transcript requests will be processed after payment is made (in advance) to the

Business Office, at the rate of \$3.00 per transcript. Mailing Address: Transcript Clerk, Room 315, Administration Building, Carleton University, Ottawa, K1S 5B6.

Reinstatement

Students who fail to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated, students must pay a reinstatement charge which consists of \$25.00 plus the current minimum tuition fee for each term in which they failed to register.

Replacement of Graduation Diplomas

A charge of \$16.00, payable in advance, will be assessed for the issuing of replacement diplomas. Replacement diplomas may be requested by writing to the following mailing address: Records/Operations, Room 405, Administration Building, Carleton University, Ottawa, K1S 5B6.

Gowns and Hoods

At each convocation, the University makes available to graduating students the appropriate academic regalia. The regalia will be available at a time and location to be announced in advance

Graduate Students' Association

Full- and part-time graduate students are members of the Carleton University Graduate Students' Association (GSA). The Association represents Carleton's graduate students at several levels and in various forums. The GSA has ties with the Carleton University Students' Association which provides graduate students with a variety of services.

In addition to representing graduate students in several national and provincial bodies, the GSA enjoys a strong relationship with the Ontario Graduate Association (OGA). Internally, the Association carries out numerous activities. GSA officers are representatives on various university bodies. Generally, the GSA seeks to act as a facilitator of productive interaction between the graduate student body and the university community. The GSA runs Mike's Place, a facility located on the second floor of the Unicentre.

The Graduate Students' Association office is located in Room 511A of the Unicentre, telephone 788-6616.

Health Services

The function of Health Services is to protect and improve the physical and mental health of the students and of the University community. Its responsibilities are to provide consultation, treatment, and advice on

matters of health, and to ascertain the fitness of students to perform academic work. When the necessary service cannot be provided by the program, appropriate referrals will be made. Confidentiality is respected at all times.

Health Services is staffed by physicians, psychiatrists, nurses and administrators. The clinic is located on Level 6 of the University Centre. Office hours are Monday to Friday, 9:00 A.M. to 5:00 P.M.; evening clinics are also available. Appointments may be made by calling 788-6674.

Students who become seriously ill when the clinic is closed should go to the nearest hospital emergency. For problems of a less serious nature a doctor may be contacted for advice through Health Services at 788-6674.

Health Services has a programme to promote healthy life-styles and wellness. On-going educational programmes and activities are offered, e.g., sexuality, alcohol awareness, eating disorders, smoking cessation, etc. For further information contact the Health Education at 788-6676.

Health Regulations

Medical insurance is compulsory for all full-time students. It is the student's responsibility to provide the insurance number when receiving medical care.

All Ontario students should be covered by OHIP. Continued coverage is not automatic after the student's twenty-first birthday and it must be applied for in the student's own name. Full-time students may be eligible for premium assistance to help pay the OHIP premium.

Students whose home residence is outside Ontario should have coverage under their own provincial plan. These claims for medical services are processed directly at Health Services.

Students entering Ontario from outside Canada and applying immediately for OHIP coverage will have effective coverage the first day of the month following application.

Immunization Record

It is recommended that new students:

1. have a tuberculin skin test unless they are tuberculin-positive, in which case a chest x-ray is required; and
2. obtain from their family physician documentation of their immunization status to red measles, German measles, mumps, polio and tetanus.

Housing and Food Services Residences

Residences

There are currently five residence houses on the Carleton campus which accommodate a total of 1,338 students in male, female, and co-educational living arrangements.

Residence accommodation is for full-time graduate and undergraduate students. Graduate and senior undergraduate students are normally accommodated in single rooms. Graduate students are, when possible, given rooms in the graduate suites in Glengarry House, or on the eleventh floor of Glengarry House. Currently, there are no facilities on campus for married students.

Residence applications are sent to students *only* when they are offered admission to full-time study at Carleton.

Off-Campus Housing

An off-campus housing information service is available to students who are unable to obtain or do not wish to have on-campus residence accommodation. The service has been established to assist out-of-town students, but is in no way a rental agency.

Listings of available accommodations are posted in the second-level corridor of the Commons Building. This area is open seven days a week, night and day. Listings of accommodation are not mailed out as such lists become outdated too rapidly.

Food Services

All students residing in residence are provided with 14 meals a week (lunch and dinner). The breakfast plan is optional, and is not included in the residence fees.

Students living off campus may use the residence dining facilities by purchasing a campus dining plan, or eating individual meals in the dining halls. Campus dining plans purchased by students are not subject to provincial sales tax. Additional dining, cafeteria, and vending facilities are located throughout the campus.

For further information, students should contact the Student Housing Office, Room 223, Commons Building.

Library Regulations

All persons registered at the University are entitled to use the library. Graduate students may borrow most books for a period of up to four weeks, although some books are placed on "Reserve", and may be borrowed for five days only, or on an overnight basis. Alumni of Carleton University, on payment of the appropriate fee, and graduates and students of other universities, on payment of the appropriate fee, and at the discretion of the University librarian, may have limited borrowing privileges. The University participates in Ontario and Quebec inter-university borrowing arrangements, which allow students in good standing to borrow directly from other Ontario and Quebec universities. The Center for Research Libraries, considered an extension of the Carleton University Library, offers students access to their library materials through the Interlibrary Loans department.

If books are not returned to the library when due, late return fees and billing costs will be charged.

The book collection is protected from theft by an electronic detection system, and as a condition of use of the library facilities, all users must, if requested to do so, submit books, briefcases, bags, etc., for inspection at the exit.

Office of the Ombudsman

The Office of the Ombudsman deals with a variety of grievances and complaints as well as with requests for information. On-campus and off-campus problems are handled by the staff (i.e. academic appeals, landlord-and-tenant problems, consumer problems, etc.). Financing of this service is provided equally by the University and the Students' Association (CUSA).

The Ombudsman's Office also publishes *Survival*, an information guide that should be helpful to all students.

Jim Kennelly
University Ombudsman

Room 511, University Centre
Telephone 788-6617

Placement and Career Counselling — Canada Employment Centre

The Placement and Career Counselling Service is provided by Employment and Immigration Canada, through the establishment of an on-campus Canada Employment Centre (CEC). The CEC is located in Room 508 of the University Centre, and may be reached by phone at either 788-6611 or 996-9590. The purpose of the CEC service is twofold:

- *To provide students with readily available access to employment opportunities*

To this end, the centre maintains job boards listing part-time, summer, and permanent employment opportunities. Each year the centre also arranges for a large number of representatives from government, as well as from business and industry, both local and national, to recruit at Carleton. While the majority of these visits are for permanent employment, a number of them are arranged for under graduates seeking summer employment. Students interested in participating in this program are advised to contact the centre upon returning to classes in the fall, as recruiting visits commence early in October.

- *To provide students with information about and assistance in preparing for entry into the labour market*
- Group counselling, covering such topics as labour

market trends, the job hunt, and résumé preparation, is available to students seeking or preparing for employment. Students can supplement the counselling provided by reviewing materials maintained in the centre's library, as well as by contacting Counselling Services at the University.

All placement and career counselling information may be obtained by visiting the centre, or by referring to the *CEC Bulletin* posted throughout the University. The University newspapers and radio station are additional sources for information from the centre.

Status of Women

In January 1983 the University established the position of Status of Women Co-ordinator to facilitate structural changes at the University to address status of women issues. If you have a personal concern, or would like to explore opportunities for women at the University, you are welcome to drop by the office or make an appointment to see the Co-ordinator. The secretary for the office, Cheryl Macaulay, is in 446 St. Pat's (788-5622) between 9 A.M. and 3:00 P.M., weekdays. The Co-ordinator, Fran Klodawsky, normally works between 9 A.M. and 5 P.M. but is also available for evening appointments.

Student Government

All registered students, full- and part-time, are members of the Students' Association. The Students' Association has many functions: providing services to students, creating community awareness of our campus, and representing student views on a wide range of interests both internally and externally.

The legislative body of the association is the Students' Council, elected in February for a 12-month term beginning the following May. The graduate representative is chosen by the GSA in October. The February election sees selection of the president, finance commissioner, and faculty representatives; the vice-presidents are chosen by the president from among these representatives, and ratified by council shortly thereafter.

The Students' Association provides numerous services, including Oliver's Pub, Rooster's Coffee House, Peer Support, the Women's Centre, International Students' Centre, a Mature and Part-Time Centre, the Carleton Disabled Awareness Centre, an Off-Campus Students' Centre, Photo Service, a Student Employment Labour Pool, Information Carleton, the Games Area, The Store, amongst other things. It funds *The Charlatan*, the campus newsmagazine, which has recently become autonomous from CUSA. CUSA also helps fund CKCU-Radio Carleton, an FM station

which broadcasts on 93.1, that is heard all over the national capital region and in points of eastern Ontario.

Many Students' Association operations emanate from the University Centre, with policy set by the Students' Council. The Unicentre, open from 7:30 A.M. to 2:00 A.M. most days, includes, in addition to the CUSA operations, facilities for food service, a faculty club, lounges, Health Services, the Canada Employment Centre, and the Ontario Public Interest Research Group (OPIRG).

Students' interests are represented by the association's membership in the Canadian Federation of Students, and by the on-campus work of the Students' Council on issues ranging from government cutbacks to housing shortages and bus-route alterations. To aid in this work, CUSA has a full-time staff, which works to benefit and improve the association and its membership. CUSA relies on input from *all* students to continue to be as successful in the future as it has been in the past.

The Students' Association offices are located in Room 401 of the Unicentre, and may be reached by phone at 788-6688.

Student Participation in Academic Affairs

There are many different ways for students to get involved in Academic Affairs. Participation of graduate students is especially welcome because they have usually been here longer than undergrads. Each department has a system known as New University Government (N.U.G.). As a NUG rep you are able to participate in the decision making process within your department and at the Graduate Faculty Board level as well.

The second level of involvement is at the Senate level. Senate is the highest academic decision-making body on campus. Out of the ten student Senators, two spots are specifically saved for graduate students. The only catch is you must be a NUG rep to stand for Senate election.

Both Senate and NUG are valuable ways to make changes within your department and throughout the university.

For information, on either of these contact the V.P. Academic, CUSA, 788-6688.

Awards and Financial Assistance

General Information

Medals

- The Governor General's Medal - Master's Degree Program Awarded annually to the graduating student with the highest academic standing in a Master's degree program. Donor: Her Excellency the Governor General of Canada. Established in 1988.

- University Medal at the Ph.D. Level

Awarded at each convocation ceremony, when merited, to a graduating student for outstanding academic achievement at the Ph.D. level. Established in 1982.

- University Medal at the Master's Level

Awarded at each convocation ceremony, when merited, to a graduating student for outstanding academic achievement at the Master's level. Established in 1982.

Awards Policy

In recent years Carleton graduate students have won a large number of external scholarships, such as SSHRC fellowships and NSERC and Ontario government scholarships. In addition, the University itself provides generous support, and the majority of graduate students receive funds from this source.

Holders of awards must pay regular tuition fees unless otherwise stated.

Full-time graduate students at Carleton are expected to comply with the following procedures:

- Any full-time graduate student who accepts an award that is not directly administered by Carleton University must immediately inform his departmental chairman and the dean of the Faculty of Graduate Studies and Research in writing. This requirement applies to any awards or assistance offered by any agency or institution.

- Any full-time graduate student who accepts part-time employment outside the University is required to inform his departmental chairman and the dean of the Faculty of Graduate Studies and Research, in writing, prior to undertaking the work.

Application Deadlines

March 1 is the last date for receipt of completed applications for admission (including transcripts, letters of reference, etc.) from candidates who wish to be considered for the initial award, announced April 1, of financial assistance administered by Carleton University.

Candidates whose applications are received after the March 1 deadline may be eligible for the award of a scholarship and assistantship by reversion.

Method of Payment

All awards administered by Carleton University will be paid on a monthly basis, with the first instalment on September 30.

Students are urged to note the above payment dates and be prepared to be financially self-sufficient during the month of September.

Other Awards

A number of national and provincial organizations award fellowships and scholarships which are tenable at Carleton University (for example, SSHRC, OGS, NSERC, etc.). Some application procedures and regulations concerning fellowships awarded by agencies other than Carleton University are given in the description of each of these awards.

In addition, a large number of foundations, companies, fraternal organizations, and other agencies offer fellowships and scholarships. A booklet providing details of deadlines and application procedures has been compiled and may be consulted in the Graduate Studies and Research Office.

Eligibility

In the case of fellowships, grants, scholarships, etc., for which students must make application, it is the individual student's responsibility to establish his/her eligibility. Should it become known that a student is unqualified for any reason, he/she must return the funds already received, with the University assuming no responsibility.

Departments recommending students for internal awards must accept full responsibility for the eligibility of their nominees.

Students are urged to consult carefully the brochures and announcements which specify the conditions associated with tenure of individual awards. This information is available in the Graduate Studies and Research Office and in departmental offices.

Awards Administered by Carleton University

The awards administered by Carleton University are derived from a variety of sources. Throughout the years, a number of individuals and organizations have contributed substantial funds to the University, through bequests and donations, in order to help support students in various fields of study.

It is not always possible to identify precisely the sources of various donations and bequests (often small,

but most important in the aggregate) from which any graduate student's financial support has been constructed. These sums, together with the assistantship funds made available from the University budget, make up the reservoir from which the Carleton scholarships and assistantships are drawn.

In the following cases, however, either because of the relative importance of the contribution or because of the fact that it is earmarked for a specific type of student or program, we do identify the external source from which the award has originated.

Auto-Carto Six Scholarship

This scholarship, in the amount of \$1,000, is awarded annually to a graduate student in geography studying computer-assisted cartography. The scholarship will be awarded, on the recommendation of the Department of Geography, on the basis of academic merit as determined by the academic index used by the Faculty of Graduate Studies and Research.

Walter Baker Fellowship

In honour of the distinguished contribution of the late Walter Baker to Canadian politics, Parliamentary life and public administration, and his long-standing dedication and service to the Ottawa community, Minto Construction Ltd. has established the Walter Baker Fellowship. Valued at \$1,000, it is awarded annually to an outstanding student entering the Institute of Canadian Studies M.A. program. Application is not required; the recipient will be chosen by the graduate awards committee from a list of candidates recommended by the director of the Institute of Canadian Studies.

Fred Barkley Special Bursary

This bursary, in the amount of \$500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The recipient of the award will be announced by the dean of Graduate Studies and Research each year.

Harold Bernstein Award in Physical Chemistry

This grant, valued at approximately \$1,000, will be awarded annually to a student joining the graduate program of the Ottawa-Carleton Institute to study and do research in the area of physical chemistry. It is a one-time scholarship, and is additional to all other stipends or scholarships that the student may hold.

The award is named in honour of Dr. Harold J. Bernstein, eminent spectroscopist and researcher, who retired from the National Research Council, Ottawa, in 1979. Dr. Bernstein served as an adjunct professor of chemistry at Carleton University from 1970 to 1979.

Peter Browne Memorial Scholarship Fund

This scholarship was established in 1983 by students, friends and colleagues of the late Professor G. Peter Browne. Application for the scholarship is not required. The recipient will be chosen by the awards committee upon the recommendation of the Department of History. Preference will be given to deserving history graduate students who are nearing the completion of their thesis.

Canadian Astronautics Limited Scholarship

This scholarship, valued at \$2,500, is provided annually by Canadian Astronautics Limited. It is awarded to a student of outstanding performance studying for a graduate degree in electrical engineering and, who is working in the field of aerospace electronics with an emphasis on microwave technology, antennas or radar.

Application is not required. The recipient will be selected on the recommendation of the Scholarship Committee, composed of the chair of the department, one other faculty member, and a representative from Canadian Astronautics Limited. The recipient of the award will be announced in January each year. In a given year, the award may not be made for lack of a suitable candidate, but will be held over so as to allow more than one recipient in a subsequent year.

R.F. Chinnick Memorial Scholarship

This scholarship is provided by Telesat Canada in memory of R.F. Chinnick, their former vice-president of engineering and operations. It is awarded annually, where appropriate, to a student enrolled in a graduate program in electrical engineering who is working in the field of satellite communications, or whose work has direct relevance to this area of telecommunications.

It is normally awarded in the second or subsequent year of graduate work, when the student's area of specialization has been well established. It may be awarded more than once to the same student, and if an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

Canadian Marconi Company Scholarship in Electrical Engineering

This scholarship, valued at \$1,000, is awarded annually, on the basis of academic achievement and on the recommendation of the Dean of Engineering, to a student enrolled in a graduate program in electrical engineering who is working in the area of analog electronic design, or antennas and propagation, or power systems, or microwave theory.

Canadian Marconi Company Bursary in Electrical Engineering

This bursary, established in 1987 by Canadian Marconi Company, is available to graduate students in Electrical Engineering who are in need of financial assistance.

Application should be made to the Faculty of Graduate Studies and Research and the recipient will be selected each year by the Dean of Graduate Studies and Research.

The Eastern Branch of the Ontario Association of Professional Social Workers Bursary

Endowed in 1985, this bursary is available to graduate students within the School of Social Work who are nearing the completion of their program and experiencing financial difficulty in meeting the costs of typing/reproduction of their thesis or independent enquiry project.

The selection of the recipient(s) will be decided on the recommendation of the director of the School of Social Work.

Davidson Dunton Memorial Student Assistance Fund

Established in 1987 by relatives, colleagues and friends of the late Davidson Dunton, Carleton's fourth and longest serving President and a Director of the Institute of Canadian Studies, this Fund is available to graduate students within the Institute of Canadian Studies who are experiencing financial difficulty meeting the costs of typing/reproduction of their thesis or other research papers, attendance at conferences, or other approved special needs.

The selection of the recipient(s) will be made upon the recommendation of the Director of the Institute of Canadian Studies.

The Dy-4 Systems Limited Graduate Scholarships in Computer Science

Two scholarships, valued at \$5,000, are awarded annually, when merited, to outstanding students entering a graduate program in Computer Science at Carleton. The recipients will be chosen on the basis of academic merit and interest in the applied aspects of computer science.

Application is not required; recipients will be chosen each year on the recommendation of the Director and the Co-ordinator of Graduate Studies of the School of Computer Science.

Rachael Elizabeth Edwards Memorial Award

Awarded annually, on the recommendation of the School of Journalism, to an outstanding student completing the First year of the Master of Journalism program. Preference will be given to a female student

who has indicated an interest in pursuing a career in the daily newspaper field.

Endowed 1974 in memory of Rachael Elizabeth Edwards, a former student in the School of Journalism. Revised 1987.

David and Rachel Epstein Foundation Scholarships

Part of the income from the David and Rachel Epstein Foundation Fund, which was established in 1970, has been designated to provide scholarships for outstanding graduate students at Carleton University.

Up to twenty scholarships valued at \$1,000 will be awarded annually to students from a list of candidates recommended by each department. Application is not required.

The David and Rachel Epstein Foundation Fellowship: Equal Pay for Work of Equal Value

Established in 1985, this fellowship is open to students studying in any discipline within the social sciences or humanities to support a master's or doctoral student in a thesis program. The thesis should be on the topic of "equal pay for work of equal value", and should have a strong empirical basis with application to Canadian work settings.

Valued at \$6,000, this fellowship is provided by part of the income from the David and Rachel Epstein Fund. It will be awarded on the basis of academic merit as determined by the Faculty of Graduate Studies and Research, from a selection of applicants who have submitted a research proposal related to the above. Departments will be asked by the selection committee to nominate suitable candidates. Deadline for the competition is February 1. In a given year, the award may not be made for lack of a suitable candidate.

Indira Gandhi Memorial Fellowship

This fellowship, to the value of approximately \$10,000, was established in 1985 by friends of India to honour the memory of Mrs. Indira Gandhi, Prime Minister of India, 1966-77, 1980-84.

It is awarded annually to an outstanding (preferably foreign) student enrolled in a graduate program. No application is required for this fellowship. The recipient will be chosen by an awards committee chaired by the dean of the Faculty of Graduate Studies and Research from candidates recommended by departments, schools and institutes having graduate programs.

Lois Gonyer Bursary

Awarded annually on application on the recommendation of the Director of the Institute of Canadian Studies to a Canadian Studies graduate student whose program is threatened because of financial need. Estab-

lished in 1988 by friends and colleagues of Lois Gonyer and funded by them and Institute graduates in recognition of her twenty-seven years of service as Administrator in the Institute of Canadian Studies.

Graduate Scholarship in Civil Engineering

This award is made possible by contributions from staff and faculty employees in Civil Engineering as well as from other donors. The award, valued at up to \$500 will be provided annually to an outstanding undergraduate student at Carleton who enrolls in a graduate program in the Department of Civil Engineering. No application is required. The recipient will be selected by a Scholarship Committee composed of the Chair of the Department of Civil Engineering, the Departmental Supervisor of Graduate Studies, and two other faculty members from the Department of Civil Engineering. (Not available 1989-90)

Neil Huckvale Memorial Scholarship

This award was established in 1981 by family, friends, and colleagues in honour of Neil Huckvale, a former graduate student in the Department of Geography. The recipient will reflect Neil Huckvale's humanity and philosophy, and will be chosen on the basis of merit and special interest in teaching and resource conservation.

The scholarship will normally be awarded annually to a student enrolled in the third or subsequent term of a graduate program in geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected on the recommendation of the graduate studies committee. If an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

International Fee Waiver Scholarships

Carleton University makes available every year a certain number of foreign fee waiver scholarships tenable at the University. These scholarships are made on similar terms to the graduate assistantships/scholarships on entrance to the program. They are for one year at the Masters level and two years at the Doctoral level. Students will be exempted from paying the foreign student fees, but will be required to pay the regular domestic fee. It is not necessary to apply separately for this scholarship. Scholarships are contingent on being accepted to a graduate program. The student will be awarded the scholarship on the recommendation of the department, and will be notified by the Dean of Graduate Studies and Research.

Zbigniew A. Jordan Scholarship

This award, established in 1978 by friends and colleagues in honour of the late Professor Zbigniew A. Jordan, is open to all graduate students in sociology.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Department of Sociology and Anthropology on the basis of merit and special interest in sociological theory and the philosophy of social sciences.

Christoph Lehmann-Halens Memorial Award

Awarded annually, when merited, to a student enrolled in the Master of Journalism degree program at Carleton. While good academic standing is an important consideration, demonstrated interest in the issues of disarmament and/or environmental protection and/or feminist concerns are the main criteria for selection.

The recipient will be chosen each year on the recommendation of the Director of the School of Journalism.

This award, in memory of Christoph Lehmann-Halens who died tragically in Libya while on assignment, was established in 1987 by his family, friends and Southam News.

The John Lyndhurst Kingston Memorial Scholarship

This scholarship was endowed in 1984 by Mrs. Leslie Kingston in memory of her late husband John L. Kingston, Architect. It is awarded annually to an outstanding graduate student studying in a discipline within the Faculties of Arts, Social Sciences, Science (including Computer Science) or Engineering, whose work is aimed at the betterment of our society.

Application is not required. The recipient will be selected by the dean of Graduate Studies and Research from a list of candidates recommended by departmental chairs from the above facilities.

The David Lewis Research Honorarium

Established in 1983 by the David Lewis Trust Fund, this \$2,500 research honorarium is awarded annually, when merited, to a graduate student enrolled in the Masters program within the Faculties of Social Sciences or Arts. It is to assist the recipient in the preparation of a thesis or research essay dealing with the labour movement and/or democratic socialism in Canada.

Candidates are initially screened by their department, and recommended to the Dean of the Faculty of Graduate Studies and Research. A short list of deserving candidates is submitted to the Board of the David Lewis Trust Fund, the members of which make the final selection of a recipient.

The winner of this honorarium will also receive an additional stipend to assist in the payment of costs associated with the writing and production of the thesis/research essay. This stipend is provided for through an endowment from the BOAG Foundation. A copy of the thesis or research essay is to be sent, upon completion, to the BOAG Foundation.

R.O. MacFarlane Memorial Book Award

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends, and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, first director of the School of Public Administration, 1953-71.

R.A. MacKay Memorial Fund

This fund was established in 1980 by relatives, friends, and former colleagues of the late R.A. MacKay, a distinguished scholar in Canadian government, a senior member of the Department of External Affairs, Professor of Political Science at Carleton University from 1961, and founding associate director of the Norman Paterson School of International Affairs, 1966-68.

The award is intended to assist graduate students from outside Canada who are studying international affairs at Carleton University; they may be enrolled in the Norman Paterson School of International Affairs or come from a related discipline, such as political science, history, or economics, provided that the "international" component of their course of study is prominent.

Maclean-Hunter Award in Journalism

Value \$1000. Awarded annually, on the recommendation of the School of Journalism, to an outstanding student proceeding from the First to the Second year of the Master of Journalism program.

Donor: Maclean-Hunter Publishing Company Limited. Established 1967. Revised 1987.

The Dewan Chand and Ratna Devi Marwah Memorial Scholarship in Economics

This scholarship, valued at \$1,000, was endowed in 1984 by Professor Kanta Marwah of the Department of Economics in honour and memory of her parents. It will be awarded annually to the most outstanding and deserving graduate student, preferably to the doctoral candidate who, having successfully completed all course and comprehensive requirements, is undertaking completion of a dissertation in the field of applied economics.

No application is required. The recipient will be selected by the Scholarship Committee, composed of the chair of the department, the director of the doctoral studies program in economics, the supervisor of M.A. studies in economics, and Professor Kanta Marwah or her designate. The recipient of the award will be announced in September each year. In a given year, the award may not be made for lack of a suitable candidate.

P.D. McCormack Fund

The purpose of the fund is to establish a memorial in perpetuity to Peter D. McCormack. The P.D. McCormack Fund is to be used for the support of graduate students in general experimental psychology in the Department of Psychology. Support may be direct (e.g. scholarships) or indirect (e.g. support of a graduate student reading room). The chair of the Department of Psychology shall determine the deployment of funds on an annual basis.

The P.D. McCormack scholarships should be considered as prestige awards in a manner similar to the Epstein Fellowships. The dean of Graduate Studies and Research, in collaboration with the chair of the Department of Psychology, will determine the number and amount of the awards in January of each year to be awarded in the following fall.

Violet McLaughlin Scholarship

This scholarship, which carries a value of up to \$1,000, was established in 1984, and is derived from a legacy by the late Violet McLaughlin to graduate students in the School of Social Work.

The scholarship will normally be awarded twice a year to a graduate student who, upon admission, possesses the highest academic standing; and to a student achieving the highest academic standing at the end of the first year of the program.

Application is not required; the recipients will be chosen by the Awards Committee from candidates recommended by the School of Social Work.

Roy Buckley Morrison Scholarship

This scholarship was established in 1979 in honour of the late Roy Buckley Morrison by Panasonic/Matsushita Electric of Canada Limited, and friends and associates. It will normally be awarded to a Canadian citizen or permanent resident of Canada, registered in the Norman Paterson School of International Affairs.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the school on the basis of merit and special interest in conflict analysis and/or studies in strategy and security.

Nabisco Brands, Inc. Fellowships

Five \$1,000 entrance fellowships provided by Nabisco Brands, Inc., to support and encourage the development of careers in international service in the public and private sectors. The fellowships are awarded annually, on the recommendation of the director of the Norman Paterson School of International Affairs, to outstanding students entering their first year of the Master of Arts in International Affairs program.

Maureen O'Neil Award in Women's Studies

This award was endowed in 1985 by Canadian Hadassah-WIZO in honour of Maureen O'Neil, Coordinator, Status of Women Canada. It is awarded annually, when merited, to a student enrolled in the Faculty of Graduate Studies and Research who is doing work in the area of women's studies.

Application is not required. The recipient will be selected by the Dean of Graduate Studies and Research from a list of candidates recommended by each department within the faculties of Arts or Social Sciences.

GAC-MAC Graduate Scholarship in Earth Sciences

This scholarship was endowed by the Geological Association of Canada and the Mineralogical Association of Canada in recognition of the support provided by the Ottawa-Carleton Geoscience Centre when Carleton University hosted the "Ottawa '86" Annual GAC-MAC Meeting.

It will be awarded annually to a graduate student enrolled in the Ottawa-Carleton Geoscience Centre. Application is not required. The recipient will be selected by the Board of Management of the Ottawa-Carleton Geoscience Centre.

The Association of Palestinian Arab Canadians Graduate Scholarship

This scholarship was established in 1988. It is awarded annually to an outstanding recent graduate of the following Palestinian universities: Bier Zeit, Al-Najah National, Al-Khaleel (Hebron), Bethlehem, The Islamic University of Gaza and Al-Quds (Jerusalem).

The recipient will be chosen by an awards committee chaired by the dean of the Faculty of Graduate Studies and Research from nominations made by the students' home institutions. It is hoped that the recipient will return to a teaching position in a Palestinian university.

Khayyam Zev Paltiel Doctoral Dissertation Prize in Social Philosophy, Social Theory or Social Policy

This prize, endowed by Professor Khayyam Z. Paltiel of the Department of Political Science, is intended to provide a fund to assist in the publication of a deserving doctoral dissertation presented to the Faculty of Graduate Studies and Research at Carleton University in the fields of social philosophy, social theory or social policy. The prize is awarded biennially to the best doctoral dissertation presented in these fields in the previous two-year period. The prize is not intended to be confined to students in a particular discipline; doctoral dissertations in the appropriate fields may be presented in political science, sociology and anthropology, economics, psychology and history. Dissertations are

nominated for the prize by doctoral examining boards; adjudication is by a Committee chaired by the Dean of the Faculty of Graduate Studies and Research, and including the appropriate Faculty Deans together with the Chairs of the relevant departments.

Paterson Fellowships

From the generous support provided by the late Senator Norman M. Paterson when the school was established in 1966, funds are allocated to support some candidates for the M.A. degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this program are considered for these fellowships.

The Norman Pollock Memorial Award for Canadian Jewish Studies

This award, endowed by David A. Pollock and Susan A. Harkavy, will be granted annually to an outstanding graduate student in the Institute of Canadian Studies for research in Canadian Jewish studies. Part of the award may be allocated towards underwriting the cost of publication of this research.

No application is required; the recipient will be selected on the recommendation of the director of the Institute of Canadian Studies. In a given year, the award may not be made for lack of eligible candidates.

John Porter Graduate Bursary

An annual bursary of \$1,000 awarded to an M.A. student in Sociology who requires financial assistance in order to complete studies at Carleton University. The selection of the recipient will be on recommendation of the co-ordinator of graduate studies, Department of Sociology and Anthropology.

The John Porter Publication Grant

This grant, established in 1979 by friends and colleagues of the late John Porter, will be awarded annually and is open to authors of book-length works. The applicants must be members of the Carleton University community whose manuscripts have been accepted by a reputable publisher, or persons not affiliated with Carleton University, whose manuscripts have been accepted for publication in the Carleton Library series.

The award, which carries a value of \$1,000 (to be applied against the costs of publication of the work), will be made on the basis of overall merit and contribution to the literature dealing with aspects of Canadian society. The recipient will be expected to deliver a public university lecture on the topic of the book, at or near the time of publication.

Applications or nominations should be directed to the Grants Committee, appointed by the Vice-President (Academic). The committee may decline to make an award in a given year for lack of meritorious candidates.

The Roderick S.J. Rooney, F.C.A. Memorial Scholarship

This scholarship was endowed in 1985 by Mrs. Isabella M. Rooney in memory of her late husband Roderick S.J. Rooney, F.C.A. It is awarded annually to an outstanding student who is enrolled in the Master of Social Work program.

Application is not required. The selection of the recipient will be decided on the recommendation of the Director of the School of Social Work.

William and Margaret Roxburgh Memorial Award

This award was established in 1981 by Gwenda and Ross Roxburgh, and is open to all graduate students in the Institute of Canadian Studies. The amount of \$150 is provided annually to assist students in carrying out research projects.

Application should be made to the director of the Institute of Canadian Studies; recipients will be chosen from a list of candidates recommended by the director.

John Ruptash Memorial Fellowship

This fellowship was established in 1974 by relatives, former students, faculty colleagues and friends as a memorial to the late John Ruptash, who was dean of engineering and later dean of graduate studies from 1959 to 1973. The fellowship has been awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering; it may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Faculty of Engineering.

Social Sciences Graduate Bursary

This fund is made possible by contributions from staff and faculty employees in the Social Sciences. Support of up to \$100 is available to graduate students nearing the completion of program and experiencing financial difficulty in meeting the costs of typing/reproduction of an M.A. or Ph.D. thesis.

Application should be made to the chair/director of the student's department, for referral with recommendation to the dean of Social Sciences.

Staff and Faculty Prize in Development Administration

Established in 1985 from the generous support provided by the staff and faculty of the School of Public Administration, this award is presented annually to an outstanding student proceeding from the first to the second year of the Development Administration stream in the School of Public Administration. The recipient will be chosen by the Awards Committee of the Faculty of Graduate Studies and Research from candidates recommended by the School of Public Administration. (Not available 1989-90)

Setsu Suzuki Scholarship

Value \$1500. Awarded annually, on the recommendation of the School of Journalism, to an outstanding student who has completed a degree in Science and is entering the Master of Journalism program.

Donor: David Suzuki. Established 1985. Revised 1987.

Philip E. Uren Fellowship

This fellowship is awarded annually to a graduate student in either the Department of Geography or the Norman Paterson School of International Affairs; it may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the awards committee from the units involved. The fellowship was established in 1980 by relatives, friends, former students, and faculty and staff colleagues as a memorial to the late Philip Ernest Uren who was a professor of geography between 1965 and 1979, and who served the University as chairman of the Department of Geography, director of the Institute of Soviet and East European Studies, director of the Norman Paterson School of International Affairs, and director of the Paterson Centre for International Programs.

John Van Beek Memorial Bursary

Valued at approximately \$1,500, this bursary is awarded annually to a student from a developing country, enrolled in the M.A. program in International Affairs, whose particular area of study is international development and who is in need of financial assistance.

The recipient will be selected by the dean of the Faculty of Graduate Studies and Research, from a list of possible candidates submitted each year by the director of the School of International Affairs. If there is more than one deserving candidate in any given year, this bursary may be split between them.

Charlotte Whitton Fellowships in Canadian Urban Life

In honour of the distinguished contribution of the late Charlotte Whitton to Canadian urban life and politics, and her long association with Ottawa, up to two fellowships in urban life will be awarded annually to the student(s) in the Institute of Canadian Studies with the highest standing on admission. The proposed field(s) of study must relate to urban life and problems.

The recipient(s) will be chosen by the dean of Graduate Studies and Research on the advice of the director of the Institute of Canadian Studies.

The Susan Joan Wood Fellowships in Canadian Literature

Three graduate fellowships provided for in the will of Susan Joan Wood, an outstanding scholar and teacher in the field of Canadian literature and a former student at Carleton University, may be awarded annually to

candidates for the M.A. degree in the Department of English. Each fellowship is valued at \$1,500. Preference will be given to candidates who plan to concentrate their studies in Canadian literature.

Graduate Bursaries

A full-time graduate student who experiences *unexpected* financial need, after completion of five weeks from the date of most recent registration, may be awarded a bursary of up to \$500 for the year. Application forms are available from the Graduate Studies and Research Office.

Residence Fellowships

Applications are invited from graduate and senior undergraduate students with good academic standing. The Residence Fellowship responsibilities include supervision of a floor in residence, enforcement of community regulations and counselling of students in residence. An excess of twenty hours per week is required to meet job responsibilities satisfactorily. Please note that the selection process demands that candidates attend an interview and a workshop in second term.

Application forms may be obtained from the Student Housing and Food Services Office, Carleton University, Ottawa, Ontario K1S 5B6. Deadline for receipt of applications is January 15.

Special Bursary for Students in Social Work

This bursary, in the amount of \$1,000 annually, may be awarded to one, or divided between two students in the School of Social Work who require special financial assistance in order to complete their studies at Carleton University. The selection of the recipient(s) will be decided on the recommendation of the director of the School of Social Work.

Awards Tenable at Carleton University

Canada Mortgage and Housing Corporation Scholarships

The Canada Mortgage and Housing Corporation offers graduate scholarships for full-time study in various fields related to housing in its urban and regional context.

This competition is open only to Canadian citizens or landed immigrants who wish to study the social, physical, environmental, economic, legislative, or administrative aspects of housing. The value of a CMHC University Scholarship is \$12,000, which is to cover all expenses, including tuition fees. The scholarship is tenable at a Canadian university only.

Application forms and additional information can be obtained from the Graduate Studies and Research Office.

Commonwealth Scholarships and Fellowships

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, offers annually a number of scholarships and fellowships, normally tenable for two years, which cover such expenses as travelling costs, tuition fees, other university fees, and a living allowance, to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these scholarships and fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult the Graduate Studies and Research Office for details of the terms of the awards, or to write to the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

I.O.D.E. War Memorial Scholarships

Nine scholarships are offered annually by the Imperial Order Daughters of the Empire for postgraduate study and research in the humanities or social sciences. The awards are valued at \$12,000 for study in Britain or another country in the Commonwealth, and \$8,500 for study in a Canadian university.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Application forms are available from the Graduate Studies and Research Office. Deadline is December 1.

Canada Department of Labour University Research Program

Grants ranging up to \$5,000 a year are provided for research studies in the field of industrial relations and labour economics. Applications are accepted from graduate students and university faculty members, provided they are Canadian citizens or can demonstrate they will be residing in Canada on a continuing basis. Further information and application forms are available from the Secretary, Department of Labour, University Research Committee, Economics and Research Branch, Canada Department of Labour, Ottawa, Ontario K1A 0J2.

Applications must be received by January 15.

Sir John A. Macdonald Graduate Fellowship in Canadian History

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at \$7,500, for full-time graduate studies and research in the field of Canadian history at the Ph.D. level. The fellowship is tenable for three years, at an Ontario university only, and it will be awarded to a Canadian citizen resident in Ontario.

Application forms and additional information can be obtained from the Graduate Studies and Research Office. The deadline date for submission of completed applications to the dean of Graduate Studies and Research is February 15.

Awards for Research and Study in Mental Retardation

The National Institute on Mental Retardation offers two awards to students entering or pursuing graduate studies: Type A offers up to \$8,000, plus a travel/training award for a one-year period; Type B offers supplementary funding of up to \$2,000 per year for two years. The awards are tenable in a wide area of study, and are not limited to fields directly associated with mental retardation. The deadline for applications for Type A is February 15, and for Type B, April 15.

Department of National Defence Scholarships and Fellowships

The Department of National Defence offers scholarships and fellowships for strategic studies of relevance to current and future Canadian national security problems, including their political, economic, social, and military dimensions. Seven Ph.D. scholarships valued at up to \$10,500 and nine M.A. scholarships valued at up to \$8,000 will be awarded to cover tuition fees and related expenses. Applicants must be Canadian citizens. Deadline is February 1.

Natural Sciences and Engineering Research Council

NSERC Postgraduate Scholarships (\$13,500 Engineering and Computer Science; \$12,500, Others) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply through their departments, on or before November 1, on prescribed forms available from the Graduate Studies and Research Office.

1967 Science Scholarships

NSERC annually offers 1967 Science Scholarships, valued at \$18,000 for 12 months, plus a travel grant.

The university selection committee will determine which, if any, of the candidates for postgraduate scholarships (for a first year of graduate studies) are sufficiently outstanding to be nominated for a 1967 Science Scholarship. Applications (including supporting documents) must be sent to the Graduate Studies and Research Office by November 1.

These awards are tenable in any Canadian university other than the one from which the candidate expects to receive his/her bachelor's degree.

Noranda Bradfield Graduate Fellowships Program

The Noranda Bradfield Graduate Fellowships are given to promote and encourage research collaboration between Canadian universities and companies in or associated with the Noranda Group. Up to seven Fellowships, each valued at \$15,000, are available to full-time students in graduate programs leading

towards a Master's or Doctoral degree working in the natural and applied sciences, mathematics, economics, business and commerce.

Application should be made through the appropriate university department to the Secretary, The Noranda Bradfield Graduate Fellowship Program, Noranda Research Centre, 240 Hymus Boulevard, Pointe Claire, Quebec, H9R 1G5 not later than March 1.

Ontario Graduate Scholarships

The Province of Ontario annually offers scholarships of \$3,170 per term to students who intend to pursue graduate studies at an Ontario university. Applicants must have maintained an overall average of B+ or the equivalent during their last two years of study.

Application forms and brochures containing details of the award may be obtained from the Graduate Studies and Research Office. The student should submit completed application forms to their department. The department will advise students of the relevant deadlines.

The Queen Elizabeth II Ontario Scholarships

The Queen Elizabeth II Ontario Scholarship Fund provides a number of annual awards in the fields of humanities, social sciences and mathematics, for candidates expecting to be in the final year of their Ph.D. research and writing during their tenure of the award.

These scholarships, valued at \$12,300, plus a general expense allowance of \$500, are open only to Canadian citizens and landed immigrants, and are tenable only at Ontario universities. Preference will be given to candidates who are residents of Ontario.

Prescribed application forms are to be completed and submitted to the dean of Graduate Studies and Research by December 1, for transmission to the selection committee by December 15.

J.H. Stewart Reid Memorial Fellowship

This fellowship provides an award of \$5,000 for 12 months for any field of study in a graduate program in any Canadian university. It is open to students who are Canadian citizens, or who have held landed immigrant status from February 1, 1978 and have been admitted to a Canadian graduate program by the time of award. Applications, due February 28, may be obtained from the awards officer, Canadian Association of University Teachers, 294 Albert Street, Suite 308, Ottawa, Ontario.

Social Sciences and Humanities Research Council of Canada

The council offers fellowships ranging in value up to \$12,240 for studies and research at the doctoral level in the humanities and social sciences.

These fellowships are tenable in Canada or abroad for a maximum of 12 months and may be renewed upon application.

Application forms and brochures containing details of the assistance programs available may be obtained from the Graduate Studies and Research Office, or by writing to the council, P.O. Box 1610, Ottawa, Ontario, K1P 6G4. Applications must be submitted by November 15.

Queen's Fellowships

Two or three Queen's Fellowships will be awarded annually to the most highly-ranked Doctoral Fellowship recipients entering the first year of a doctoral program in Canadian Studies. The Fellowships are tenable only at a Canadian university and will provide tuition and travel costs in addition to the basic Doctoral Fellowship award.

Joint Initiative: SSHRC/FCAR/NSERC

Doctoral fellowships offered under the SSHRC/FCAR/NSERC Joint Initiative program are intended to encourage students to change their linguistic milieu and their place of study from Quebec to another province and vice versa. Applicants must submit an application to the SSHRC's regular Doctoral Fellowships program and be successful in the competition. The proposed program of study and the university of affiliation must involve a move from a university outside Quebec to a university within Quebec and vice versa as well as a change in the language of study from that of the undergraduate program. In addition to the Council award, successful applicants will be awarded a supplement of \$4,000 per year by the Fonds FCAR, renewable for as long as they are holders of a SSHRC Doctoral Fellowship. Tuition fees in excess of \$600 will also be paid by the Fonds FCAR.

Government Aid Programs

Ontario Residents

Canadian citizens or landed immigrants (permanent residents) who are residents of Ontario may qualify for assistance from the Ontario Student Assistance Program. The financial aid scheme is designed to supplement, rather than replace, family and/or student resources. In order to determine the additional funds required, the province objectively assesses the resources that could reasonably be used to provide for the student's educational costs. The assistance could be in the form of an Ontario Study Grant, a Canada Student Loan and/or Ontario Student Loan. The maximum loan/grant award a student can receive in one academic year is usually the total amount of his or her allowable educational costs. Application forms and further information can be obtained by contacting the Awards Office at Carleton or the Student Awards Branch of the Ministry of Colleges and Universities, Mowat Block, Queen's Park, Toronto, M7A 2B4.

Students wishing to have applications processed in time for fall registration must ensure that completed forms are submitted to the Awards Office by July 1.

Residents of Other Provinces/Territories Except Quebec

Canadian citizens or landed immigrants (permanent residents) from the territories and all other provinces except Quebec may qualify for assistance from the Canada Student Loans Plan through their home province. The maximum loan available per academic year is currently \$3,570. The loan is interest free while the student is enrolled full time and for six months thereafter. Some provinces also make available non-repayable grant assistance along with this federal loan.

The Awards Office disburses general information on the various provincial aid schemes but application forms and details on individual programs must be obtained from the authorities in the home province. Deadline dates vary but, generally speaking, it is wise to apply for financial assistance through the appropriate provincial department before June 30.

Quebec Aid

Applications from students for assistance from the province of Quebec should be made directly to the Awards Office. Deadline dates for submission of applications are May 31 for all students who submitted an application for the previous school year and June 30 for all students who did not submit an application for the previous school year. In order to be accepted by the Department of Education, all applications must be coded by the Awards Office.

University Loan Funds

Students who have completed at least one successful year at Carleton University and who are not eligible to receive assistance from other sources of financial aid, may apply for a loan from the John Parker Loan Fund. The maximum loan is \$1,500. This fund also provides emergency loans for 60 days or less to students whose funds from other sources have been delayed. Application forms are available to students in the Awards Office, 202 Administration Building, telephone 788-3600.

The first part of the paper is devoted to a general discussion of the problem of the origin of life. It is shown that the problem is one of the most important and most difficult in the history of science. The author discusses the various theories of the origin of life, and shows that the most plausible is the theory of spontaneous generation. This theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor. The author also discusses the problem of the origin of the first living organisms, and shows that the most plausible theory is the theory of abiogenesis. This theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor. The author also discusses the problem of the origin of the first living organisms, and shows that the most plausible theory is the theory of abiogenesis. This theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor.

The second part of the paper is devoted to a detailed discussion of the theory of spontaneous generation. It is shown that this theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor. The author discusses the various theories of the origin of life, and shows that the most plausible is the theory of spontaneous generation. This theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor. The author also discusses the problem of the origin of the first living organisms, and shows that the most plausible theory is the theory of abiogenesis. This theory is based on the fact that life is a complex of many different parts, and that these parts are all derived from a common ancestor.

Departmental

Program

Descriptions

and

Details

of

Courses

Faculty of Arts

Dean: Janice M. Yalden

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Department of Art History

Dunton Tower 2201

788-2342

The Department

Chair of the Department: Roger J. Mesley

Departmental Graduate Co-ordinator:

Kelly Crossman

The Department of Art History offers seven courses at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

- Art History 11.502W1

Aspects of Canadian Indian Art

A tutorial to study specific areas of pre-historic, historic, and contemporary Canadian Indian art.

The topic for 1989-1990 is the art of the Plains Indians.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.505F1, W1, S1

Directed Reading and Research

Tutorials designed to permit advanced students to pursue topics in Canadian art which they have selected in consultation with the staff.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

Departmental co-ordinator and members of the curatorial staffs, National Museums of Canada.

- Art History 11.506F1, W1, S1

Directed Reading and Research

Tutorials designed to permit advanced students to pursue topics in Canadian art which they have selected in consultation with the staff.

Prerequisite: Permission of the Department and the Institute of Canadian Studies.

Departmental co-ordinator and members of the curatorial staffs, National Museums of Canada.

- Art History 11.590F1, W1, S1

Practicum in Art History

An option enabling graduate students to gain practical experience by working on specific projects in art history or architecture under the supervision of the staff of one of the museums or related settings in the Ottawa

area. Readings, discussions and written reports are integrated with ongoing programmes in the different settings. Available institutions and positions within them on particular projects may change from year to year. A maximum of one full credit of practicum may be offered in fulfillment of the requirements of the MA degree.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

Departmental Practicum Supervisor and members of the curatorial staffs, National Museums of Canada and others.

Courses Not Offered in 1989-90

- Art History 11.500F1

Aspects of Historical Canadian Art

A tutorial to study specific areas of historical Canadian art.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.501

Aspects of Modern Canadian Art

A tutorial to study specific areas of modern Canadian art.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.507W1

Aspects of Inuit Art

A tutorial to study specific areas of prehistoric, historic, and contemporary Inuit art.

Prerequisite: Honours courses in art history or permission of the department.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Institute of Canadian Studies

Dunton Tower 1110

788-2366

The Institute

Director of the Institute: J.M. Vickers

Co-ordinator, Canadian Women's Studies:

Patricia Smart

Joint Chair, Ottawa-Carleton, Women's Studies:

Hon. Monique Bégin

Co-ordinator, Northern and Native Studies:

S.R. Mealing

Co-ordinator, Cultural Studies: Peter Harcourt

Co-ordinator, Undergraduate Canadian Studies

Program: P. Duchemin

Assistant Professor of History and Canadian Studies:

K.M. Abel

Adjunct Professors: R.T. Clippingdale,

Heather Menzies, G.W. Rowley

The Institute of Canadian Studies offers a program of study and research leading to the degree of Master of Arts in Canadian Studies.

Through the medium of the institute, the following departments co-operate in offering the programs: Architecture, Art History, Economics, English, Film Studies, French, Geography, History, Journalism, Law, Linguistics, Music, Political Science, Psychology, Public Administration, Social Work, and Sociology and Anthropology.

The Canadian studies program is interdisciplinary in emphasis. It enables students in the institute to develop individual areas of concentration to meet particular interests in a broad range of Canadian issues.

Special areas of concentration include modern Canada; communications; regional studies; urban studies; heritage conservation; French-Canadian studies; native peoples; the Canadian north; Canadian art history and music; women's studies; and studies in Canadian literature.

The proximity of Carleton University to the National Library, the National Gallery of Canada, the national museums, the Library of Parliament, the Public Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies, ensures excellent research facilities for graduate candidates in Canadian studies.

With the aid of a grant from the Donner Foundation, the institute has initiated a program area of northern and native studies. The same conditions and requirements apply as in other program areas; however, special consideration may be given to candidates for admission who have extensive knowledge of the north or of native peoples, and the language requirement may be met by a demonstrated knowledge of an aboriginal Canadian language in addition to English or French.

In 1983-84, a program area of women's studies was instituted. Both interdisciplinary and comparative in focus, the program permits students to examine the interplay within the Canadian context between gender and race, gender and nationality, gender and class, and sex/gender as a dynamic principle in the process of imperialism, nation building, and the construction of national and ethnic identities.

A new program area in heritage conservation will begin in 1989-90. With an interdisciplinary focus on the Canadian built environment, the program will permit the course of study to be tailored to individual interests and backgrounds. The department of Leisure Studies at Ottawa University, the Heritage Canada Foundation, and the Canadian Parks Service at Environment Canada will co-operate in offering the program.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees with second-class standing will be required to complete a qualifying year of study with at least high honours standing before proceeding to the master's program.

Refer to the general section of this calendar for the regulations governing the qualifying year.

Master of Arts

Admission Requirements

Applicants must normally hold an honours B.A. (or the equivalent), with at least high honours standing, in one of the disciplines represented in the institute.

Applicants are advised to submit applications well before July 1 as enrolment in the institute may be limited.

Language Requirement

The institute requires a reading knowledge of French from its students. This requirement may be met in one of two ways:

- Successful completion of a 100-level French course or its equivalent, preferably French 20.106 or 20.108
- Successful completion of a language examination.

The institute conducts the language examinations at stated times throughout the year. Students choosing the first option should note that examination results in these courses form part of their record, although they are additional to the course requirements for the degree.

Program Requirements

The minimum requirements for the master's program are outlined in the general section of this calendar. The Institute of Canadian Studies specifies that all candidates must select one of the following program patterns:

- Three full courses or the equivalent, a thesis, and an oral examination
- Four full courses or the equivalent, a research essay, and an oral examination.

Whichever pattern is selected, all institute students are required to take one of the interdisciplinary seminar, Canadian Studies 12.500, 12.510, 12.520, 12.530, or 12.540.

Thesis/Research Essay Proposal

Students are required to file with the Institute a detailed proposal of their thesis or research essay project no later than the end of the second term of registration for students enrolled full-time and no later than the end of the fifth term of registration for students enrolled part-time. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of the student's intended thesis/research essay supervisor, the Director of the Institute and the Program Area Co-ordinator.

Special Requirements for Heritage Conservation Program Area

Some knowledge of the history of Canadian architecture. This requirement may be met by successful completion of 76.302, History of Canadian Architecture, or its equivalent either before or after admission. This course is in addition to the requirements for the degree.

- Architecture 77.541T1 and 78.542T1

Graduate Courses*

Students not registered in the institute's M.A. program may take interdisciplinary seminars with the permission of the institute.

- Canadian Studies 12.500T2

Modern Concepts of Canada
Interdisciplinary seminar.

- Canadian Studies 12.510T2

Northern and Native Issues

Interdisciplinary seminar. The significance of the north to Canada, and the position of the native people in Canadian society. The impact of resource development and modern technology on both the north and the native people.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Canadian Studies 12.520T2

Women's Studies

Interdisciplinary seminar. The significance in the Canadian experience of sex/gender in the dynamics of imperialism, nation building, class differentiation, and the construction of culture; Canadian feminist theory and the history of women's movements.

- Canadian Studies 12.530T2

Canadian Culture and Cultural Policy

Interdisciplinary seminar. The nature of Canadian culture and the purposes, activities and impact of the principal Canadian institutions, agencies and systems involved with cultural production, in both the English- and French-language dimensions.

- Canadian Studies 12.540T2

Canadian Heritage Conservation

An interdisciplinary seminar providing an introduction to the cultural, economic, legal, political and technical aspects of the conservation of heritage resources. Particular attention will be given to the elements of the built environment—buildings, complexes, landscapes, and urban areas—along with their associated artifacts.

- Canadian Studies 12.580T2

Internship/Practicum

A limited number of internships and practicum placements are available each year in institutional settings outside of the University. Students are required to complete a formal written paper, in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisors.

12.581*(F) Internship/Practicum: Fall Term

12.582*(W) Internship/Practicum: Winter Term

12.583(S) Internship/Practicum: Summer Term

Students are advised to inform themselves of the Internship/Practicum placements available well in advance and to apply to the Co-ordinator of the Heritage Conservation Program Area no later than a month prior to the beginning of the term in which placement is desired.

- Canadian Studies 12.590T2, S2

Directed Studies

Reading and research tutorials.

- Canadian Studies 12.591F1, W1, S1

Directed Studies

Reading and research tutorials.

- Canadian Studies 12.592T2, S2

Directed Studies

Reading and research tutorials.

- Canadian Studies 12.593F1, W1, S1

Directed Studies

Reading and research tutorials.

- Canadian Studies 12.598F2, W2,S2

Research Essay

- Canadian Studies 12.599F4, W4, S4

M.A. Thesis

Selection of Courses

In addition to the graduate courses offered by the institute, the following courses are of particular relevance to students in Canadian studies. The list is not exclusive and is subject to change. Master's students in the institute must complete at least four courses, or the equivalent, at the 500 level, with the possibility of one course at the 400 level.

Anthropology

- 54.470 Selected Problems in the Study of North American Native Peoples
- 54.475 Contemporary Problems in Anthropology Topic for 1989-90: Native Studies and Native History
- 54.516 North American Native Studies
- 54.517 Problems in North American Ethnohistory
- 54.538 Feminist Analyses
- 54.541 Anthropological Methods
- 54.542 Explanatory Frameworks in Anthropology

Architecture

- 76.423 Society and Shelter
- 76.425 Workshop: User Analysis and Building Performance
- 77.440 Design for Construction
- 78.440 City Organization and Planning Processes
- 78.445 Workshop: Urban Design
- 76.500 Directed Studies in History and Theory of Architecture
- 77.500 Directed Studies in Architecture and Technology
- 76.501 Directed Studies in Architecture and Technology
- 78.500 Directed Studies in Architecture and the City
- 79.500 Directed Studies in Computer-Aided Design

Art History

- 11.400 Images of the Land in Contemporary Canadian Art
- 11.475 Crossing the Circle: Contemporary Indian and Inuit Art
- 11.489 Ottawa Architecture
- 11.490 Directed Readings and Research
- 11.491 Directed Readings and Research
- 11.492 Directed Readings and Research
- 11.505 Directed Readings and Research
- 11.506 Directed Readings and Research
- 11.507 Inuit Art
- 11.590 Practicum in Art History

Comparative Literature

- 17.401 Foundations of Comparative Literature
- 17.402 Theories of Literature
- 17.501 Methods of Analysis in Literary Studies I
- 17.502 Methods of Analysis in Literary Studies II
- 17.506 Styles and Periods: Women Writers Between World War I and World War II.
- 17.525 Modernism in British American and Canadian Poetry

Economics

- 43.435 Manpower Economics and Labour Policy
- 43.465 Industrial Relations
- 43.480 Urban Economics
- 43.511 Canadian Economy I
- 43.512 Canadian Economy II
- 43.531 Firms and Markets
- 43.533 Regulation and Public Enterprise
- 43.541 Public Economics: Expenditure
- 43.542 Public Economics: Taxation
- 43.581 Regional Economics
- 43.582 Urban Economics

English

- 18.581 Canadian Poetry
- 18.583 Canadian Fiction
- 18.588 Studies in Canadian Literature

Film Studies

- 19.400 Modes of Historical Research
- 19.421 Selected Topics in National Cinemas
- 19.461 Studies in Film Analysis
- 19.528 Canadian Cinema

French

- 20.504 Linguistique du français canadien
- 20.500 La pensée sociale, politique et spirituelle de Gabrielle Roy
- 20.551 La prose d'idées au Canada français. Evolution et expression d'une pensée distinctive au Canada français
- 20.570 La pensée sociale d'Hubert Aquin révélée par son oeuvre romanesque

Geography

- 45.421 Selected Themes in Urban Geography
- 45.425 Geography of Social Well-Being
- 45.426 Medical Geography
- 45.427 Urban Development and Analysis
- 45.431 Advanced Cultural Geography
- 45.442 Transportation Geography
- 45.541 Society and Space
- 45.543 Selected Concepts in Cultural Geography
- 45.545 Problems in Historical Geography
- 45.570 Problems of Development in Arctic and Subarctic Environments
- 45.572 Issues in Canadian Resource Development
- 45.579 Research and Development in Outdoor Recreational Geography

History

- 24.430 The Formation of British North American Societies, 1760-1848
- 24.437 The National Experience, 1896-1939
- 24.439 Modern Canada, 1939-1976
- 24.442 North American Colonial Rebellions and Independence Movements, 1675-1837
- 24.459 Selected Problems in the History of Women and the Family: From the Industrial Revolution
- 24.491 Directed Studies
- 24.500 Practicum in Applied History

- 24.532 Ontario in the Nineteenth Century
- 24.533 Intellectual History of Canada
- 24.535 Canada in the North Atlantic World, 1900-1949
- 24.536 Science and Technology in the Canadian Experience
- 24.537 The Maritimes in Transition, 1840's to 1890's
- 24.559 Women in Nineteenth- and Twentieth-Century North America and Britain
- 24.588 Historiography of Canada

Journalism

- 28.500 Journalism and Society I
- 28.535 Perspectives on Modern Society
- 28.541 Journalism Law
- 28.560 Journalism and Society II

Law

- 51.440 The Arbitration Process in Industrial Relations
- 51.445 Labour Relations in the Public Service
- 51.451 Selected Problems in Comparative Constitutional Law
- 51.456 Administrative Law I
- 51.457 Administrative Law II
- 51.487 Québec Civil Law
- 51.550 The Canadian Constitution
- 51.553 Advanced Legal Problems of Federalism
- 51.590 Tutorials/Directed Readings in Law

Mass Communications

- 27.411 Selected Problems in Mass-Communication Analysis
- 27.431 Communication Policy

Music

- 30.510 History of Canadian Music I
- 30.511 History of Canadian Music II
- 30.512 History of Canadian Music III
- 30.515 History of Canadian Music IV

Political Science

- 47.400 Topics in Canadian Government and Politics
- 47.401 Canadian Public Policy
- 47.402 Policy Seminar: Problems of Northern Development
- 47.403 Politics and the Media
- 47.404 Interest Groups in Canadian Politics
- 47.405 Federalism
- 47.406 Legislative Process in Canada
- 47.407 The Politics of Law Enforcement in Canada
- 47.408 National Security and Intelligence in the Modern State
- 47.409 Politics in Quebec
- 47.501 Canadian Provincial Government and Politics
- 47.503 Political Parties in Canada
- 47.504 Policy Making in Canada
- 47.506 Problems of Canadian Government and Politics

- 47.507 Problems of Canadian Government and Politics
- 47.508 The Politics of Energy and the Environment
- 47.509 Canadian Political Economy
- 47.511 Canadian Federalism
- 47.520 Nationalism
- 47.521 Politics in Plural Societies
- 47.536 The Canadian and American Political Traditions I
- 47.537 The Canadian and American Political Traditions II
- 47.541 Canadian Public Administration and Policy Analysis
- 47.561 Analysis of Canadian Foreign Policy
- 47.600 The Political Process in Canada I
- 47.601 The Political Process in Canada II

Psychology

- 49.590 Directed Studies

Public Administration

- 50.500 Public-Sector Managing and the Canadian Political System
- 50.515 Management in the Public Service
- 50.516 Urban and Local Government Management
- 50.560 Economic Aspects of Industrial Policy
- 50.561 The Politics of Industrial Strategy
- 50.567 Political Economy of the State
- 50.584 Industrial Relations and Collective Bargaining
- 50.585 Public-Sector Collective Bargaining

Social Work

- 52.502 Economics of Welfare
- 52.503 Foundations of Sexuality
- 52.504 Social Work and the Law
- 52.506 Women and Welfare
- 52.510 History and Philosophy of Social Welfare
- 52.511 Social Policy Analysis
- 52.515 Poverty and Wealth
- 52.517 Social Policies for Children

Sociology

- 53.451 Workshop in Demography/Human Ecology
- 53.452 Workshop on Work and Organizations
- 53.485 Contemporary Problems in Sociology
- Topic for 1989-90: Sexuality and Reproduction in Feminist Theory
- 53.525 Canadian Society
- 53.532 The Labour Process
- 53.538 Feminist Analyses
- 53.540 Political Sociology
- 53.545 Power and Stratification
- 53.568 Women and Work
- 53.586 Selected Topics in Sociology: The Sociology of Language
- 56.465 Selected Problems in the Study of Ethnic and Race Relations

Department of Classics

Dunton Tower 2015
788-2301

The Department

Chair of the Department: TBA

Departmental Supervisor of Graduate Studies: TBA

The Department of Classics offers programs of study leading to the degree of Master of Arts. The following four program categories are available:

- Classics
- Greek only
- Latin only
- Ancient History

At present the Department is not accepting any new applicants into these programs.

Qualifying-Year Program

Applicants who hold a general (pass) B.A. degree will normally be required to complete successfully a qualifying-year program before proceeding to the master's program. Refer to the general regulations section of this calendar for the regulations governing a qualifying year.

Program Requirements

The qualifying-year program will correspond quite closely to the final year of the honours under-graduate program offered by the Department of Classics, although it may include graduate courses.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours B.A. degree in Classical Civilization, Ancient History, Classics, Latin, or Greek, with high second-class standing.

Program Requirements

The regulations governing program requirements are outlined in the general regulations section of this calendar. Master's students can complete their program requirements in one of two ways, either by completing two full courses (or the equivalent) at the 500 level and a thesis equivalent to three full courses, or by completing four full courses (or the equivalent) at the 500 level and a research essay equivalent to one full course.

The department also specifies the following:

- Students entering the program with a degree in classical civilization must have one full course credit in Latin or Greek at the 200 level (or the equivalent) and the other of the two languages at the level of 115 (or the equivalent). A minimum grade of B- will normally be required in these language courses. In special circumstances, the department will allow a student to enter the master's program with less than these requirements, but in that case, the student will have to reach the necessary standard before graduation.
- Students taking the degree in Greek only must have credit in senior matriculation Latin, or an approved equivalent; those in Latin only must have credit in Greek 15.115 (or the equivalent). A minimum grade of B- will normally be required.
- All students must demonstrate a knowledge of German. Credit in German 22.115, or an approved equivalent, will be accepted.

Graduate Courses*

- Classics 14.505F1
Introduction to Linguistics
- Classics 14.506W1
Elementary Textual Criticism
- Classics 14.520T2
A Greek Author
- Classics 14.521T2
A Latin Author
- Classics 14.530T2
A Greek Literary Genre
- Classics 14.531T2
A Latin Literary Genre
- Classics 14.550T2
A Greek Historical Period
- Classics 14.551T2
A Roman Historical Period
- Classics 14.552T2
A Topic in Greek and Roman History
- Classics 14.598F2, W2, S2
Research Essay
- Classics 14.599F6, W6, S6
M.A. Thesis

*F, W, S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Comparative Literature Committee

Dunton Tower 1726

788-2177

The Committee

Chairman of the Committee: A.T. Tolley

Assistant Chairman: F.G. Loriggio

The Comparative Literature Committee offers programs of graduate study leading to the degree of Master of Arts. These programs, involving courses in comparative literature and, where appropriate, up to two courses from other departments, have considerable flexibility in the sense that they can be tailored to suit each student's special interests in particular periods or areas while, at the same time, through the core half-courses Comparative Literature 17.501 and 17.502 and the final comprehensive, providing a specialized training in the techniques of comparative literature.

The purpose of the comparative literature program is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies, such as the various literatures, philosophy, psychology, sociology, the visual arts, and history, "comparatists" view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, and consideration of the less well known literatures of the world are some of the objects of comparative literature studies.

The study of this discipline must be based on a truly comparative perspective, on a solid linguistic foundation, and on an awareness of all difficulties that arise in comparative literature, conceived as a domain both within and beyond the limits of national literatures.

Students registered in other departments, who wish to register in one or more courses from the comparative literature program, must demonstrate a reading knowledge of the languages required for each course. Such students are encouraged to emphasize their own area of literary study in presentations and essays when the instructor judges that the content of the course(s) so permits. Three years of study at the university level will normally constitute the required level of language proficiency.

Qualifying-Year Program

The regulations governing admission to the qualifying-year program are outlined in the general section of this calendar.

Applicants who hold only a general (pass) B.A. degree will be required to complete successfully the basic half-courses, Comparative Literature 17.401: Foundations of Comparative Literature and Comparative Literature 17.402: Theories of Literature, and to take courses from other departments of literature, or comparative literature (see undergraduate calendar) to achieve the equivalent of a combined honours B.A. with high honours standing.

The total course program is to be worked out in consultation with the graduate studies supervisor. Formal admission to the master's program may be considered at the end of the first term.

- Comparative Literature 17.401

Foundations of Comparative Literature

The history of the discipline of comparative literature will be studied, including its beginnings in nineteenth-century France, its evolution, and its current status in Europe, the United States, and Canada.

Prerequisite: Permission of the committee.

F. de Toro.

- Comparative Literature 17.402

Theories of Literature

The course focuses on twentieth-century literary theories in the context of comparative studies, providing the student with an overall view of the theoretical discussion of literature from about 1920 to the present. Included in the study are Russian Formalism, American New Criticism, and such other approaches as the structuralist, semiotic, socio-cultural and hermeneutic.

Prerequisite: Permission of the committee.

(Students enrolling in this course under the cross-listed 38.402 should note the requirements of the Department of Spanish).

F. Loriggio.

Master of Arts

Admission Requirements

The regulations governing admission to the master's program are outlined in the general section of this calendar.

The specific requirements for admission to the master's program in comparative literature are the following:

- An honours B.A. degree (or equivalent) with at least high honours standing in a literature (studied in the original language) or in two literatures or in a literature and a related Arts subject
- Proficiency in English
- An ability to work at the graduate level in an additional language approved by the Committee. Students whose record does not clearly demonstrate this ability will be required to take as part of their program at least one half-credit in the literature of this second language in the original language.

Program Requirements

Students accepted into the master's program without having taken the two half-courses, Comparative Literature 17.401 and Comparative Literature 17.402 (or their equivalent), will be required to take these courses as extra to the degree.

The program requirements for master's candidates in comparative literature are the following:

- The two half-courses, Comparative Literature 17.501: Methods of Analysis in Literary Studies I and Comparative Literature 17.502: Methods of Analysis in Literary Studies II.
- *One of the following two combinations:*
Three graduate courses selected from those offered by comparative literature and other departments; (one 400-level course may be substituted for a graduate course) or
Comparative Literature 17.599: M.A. Thesis, plus one graduate course
- Comparative Literature 17.593: Comprehensives in Comparative Literature (written and oral).

Course Patterns

Certain course offerings by other departments have been drawn up by area for 1989-90. Students may wish to choose course options from:

Theories and Techniques of Analysis

Art History

- 11.431 Topics in Iconography

French

- 20.541 Sémiotique littéraire
20.542 Théories générales de la littérature
20.543 Littérature et idéologie
20.562 Littérature, société, communication
20.570 Aspect littéraire/culturel particulier

German

- 22.472 Literary Semiotics

Mass Communications

- 27.411 Selected Problems in Mass Communication Analysis

Linguistics

- 29.409 Seminar in Current Issues in Linguistics

Sociology and Anthropology

- 53.500 Classical Sociological Theory
53.536 Cultural Studies
53.537 Psychoanalysis and Cultural Studies
53.539 Cultural Theory
53.583 Critical Theory
56.460 Studies in Applied Semiology

Literature in a Multicultural Context

English

- 18.581 Canadian Poetry
18.583 Canadian Fiction

French

- 20.545 Thèmes écolés, mouvements
20.551 Littérature canadienne-française II

Spanish

- 38.560 Aspects of Spanish-American Literature after 1888
38.570 Special Problems in Spanish-American Literature

Historical Period Studies

Art History

- 11.431 Topics in Iconography

French

- 20.544 Auteurs
20.546 Genres I
20.547 Genres II
20.548 Littérature française I
20.549 Littérature française II

German

- 22.541 Formen der Kurzprosa
22.567 Period Studies
22.582 Mittelalterliches Deutsch

Spanish

- 38.520 Special Topic on Golden Age Literature

Modern Literature

English

- 18.561 Twentieth Century Poetry
18.563 Twentieth Century Fiction

French

- 20.550 Littérature canadienne-française I

German

- 22.562 Die Literatursprache des 20. Jahrhunderts in diachronischer Sicht

Spanish

- 38.530 Problems of Modern Spanish Literature
38.560 Aspects of Spanish-American Literature after 1888

Graduate Courses*

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of the Comparative Literature Committee. A student may not receive credit for both a half-course and a full-course which bears the same topic title.

• Comparative Literature 17.501F1

Methods of Analysis in Literary Studies I

Topic for 1989-90: Sociological Perspectives on Literary Textuality

The focus will be upon the theory of the literary field ("théorie du champ littéraire") and on the description of its components: poles, forces, agents, processes, acts of communication and of socio-cultural information. The institution and its confines; the product of praxis: the literary text. Relations with neighbouring fields: language, education and various other cultural domains. Theory and description will be illustrated through "case studies", with emphasis upon the notions of textuality, context and conditions of text production.

Prerequisite: Permission of the committee.

S. Sarkany.

• Comparative Literature 17.502W1

Methods of Analysis in Literary Studies II

Topic for 1989-90: Rhetoric and Narratology

An examination of manipulation in Narrative. Theorists of fiction, historiography and propaganda whose works would be read include: Aristotle (*Poetics, Rhetoric*); Brooks (*Reading for the Plot*); Pavel (*Fictional Worlds*); Prince (*A Dictionary of Narratology*); Debray Genette (*Metamorphoses du récit*); McHale, (*Postmodern Fiction*). Among the fictional texts studied: Flaubert, *Trois Contes*; Barnes, *Flaubert's Parrot*; Allen, *Side Effects*; Barth, *Lost in the Funhouse*; R. Ducharme, *L'Avalée des avalés*.

Prerequisite: Permission of the committee.

A. Halsall.

• Comparative Literature 17.505W1

Translation Workshop

This course will deal with theoretical as well as practical aspects of translation of poetry. Texts of modern English and French Canadian and of English and American poets will be studied.

Prerequisite: Permission of the committee.

(Also offered as French 20.507)

E. Voldeng.

• Comparative Literature 17.506T2

Styles and Periods

Topic for 1989-90: Women Writers Between World War I and World War II

This course will examine fiction by Scandinavian, English, French, American and Canadian women writers between the World Wars. The works will be viewed in a socio-cultural context, and particular attention will be paid to the women in the narrative and to their interrelationships from the point of view of feminist criticism. Texts by such authors as: Dinesen, Undset, Woolf, Colette, Stein, Ostenso, Salverson.

Prerequisite: Permission of the committee.

G.A. Woods.

• Comparative Literature 17.508F1

Study of Theme and Motif

Topic for 1989-90: Literary Semiotics

Studies of film scenes taken from plays by Molière, Marivaux, Diderot, Sartre, and from a contemporary Quebecois play.

Prerequisite: Permission of the committee.

(The course will be given in French)

(Also offered as French 20.541*)

S. Sarkany.

• Comparative Literature 17.511F1

Special Topic in Fiction

Topic for 1989-90: Umberto Eco and David Lodge: Semioticians, Narratologists and Novelists

Eco's works figure largely in two of the areas of principal interest to contemporary students of fiction: as a semiotician in *A Theory of Semiotics*, and as a narratologist, from his thesis on Joyce, *The Aesthetics of Chaosmos*, to *The Role of the Reader*. As a novelist, he produced in *The Name of the Rose*, a fictional exemplar of his theories, which permits their practical analysis.

Lodge is equally well known as a critic and theorist of fiction: through *The Language of Fiction* and *Working with Structuralism*; and through half a dozen novels, from *Ginger*, *You're Barmy* to *Changing Places* and *Small World*.

Students would read all the texts mentioned as well as any others by both authors likely to be useful.

Prerequisite: Permission of the committee.

A. Halsall.

• Comparative Literature 17.525T2

Literary Movements in the Nineteenth and Twentieth Centuries

Topic for 1989-90: Modernism in British, American and Canadian Poetry

A comparative historical study of the development and influence of modernism in British, American and Canadian poetry. The course will in part be structured in terms of contrasts between poets who were rough contemporaries in the three cultures, such as Hopkins and Whitman, or Lowell and Larkin.

Prerequisite: Permission of the committee.

A.T. Tolley.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Comparative Literature 17.530F1

Seminar in Comparative Literature

Topic for 1989-90: Literature, Society and Communication

The course will deal with the sociology of the writer and the profession of the writer. It will explore the relationships between institutional and environmental conditions on the one hand and intellectual and artistic ambitions and achievements on the other hand. Authors to be studied include Proust, Larbaud, Morand, Aveline, Frechette, Godbout, Perrault. The work of the theoreticians dealt with will include that of Chamboredon, Escarpit, Bourdieu and Dubois.

Prerequisite: Permission of the committee.

(The course will be offered in French)

(Also offered as French 20.562*)

S. Sarkany.

- Comparative Literature 17.531W1

Seminar in Comparative Literature

Topic for 1989-90: Dialogue and Dialogism in Literary and Other Discourses

A study of the notion of dialogism and its impact on recent criticism. Attention will also be given to the background of the notion and the issues it has given rise to in disciplines such as philosophy, sociology or anthropology. Theoretical texts will come from Bakhtin, Gadamer, Buber, Peirce, Grice, Rorty, Burke. In literature Dostevsky and Pirandello will provide the touchstone material.

Prerequisite: Permission of the committee.

F. Loriggio.

- Comparative Literature 17.534F1

Study in Literary Genres

Topic for 1989-90: The Latin American Novel

The purpose of this course is to offer a critical perspective of the New Novel in Latin America (1949-1980). The novels chosen belong to the so called "Boom" period, which is characterized by a new mode of narrating. Various approaches will be introduced in order to give an account of the variety of narrative techniques employed in the corpus (narrative semiotics, reception theory). At the same time the narrative discourse will be studied from a contextual point of view, in order to link narrative production to social production (Marxist theory of literature).

Prerequisite: Permission of the committee.

F. de Toro.

- Comparative Literature 17.561T2

Studies in Literary Genres

Topic for 1989-90: Poetry of the French-Speaking World

The study of poetry written in French in cultures other than metropolitan France, where French is the first or unifying language. African, American, Asian and European poetry will be discussed in the light of problems of cultural identity and of aesthetic differences

and similarities. Texts will be analysed from the poetic, semiotic and ideological perspectives.

Prerequisite: Permission of the committee.

(This course will be given in French).

P. Laurette.

- Comparative Literature 17.591T2

Seminar in Comparative Literature

Topic for 1989-90: Cross Cultural Reception and Influence.

A study with particular emphasis on the cross-cultural reception of texts and the problem of influence. Special attention will be given to the notion of "receptiveness" as a feature of the receiving culture. Topics will include: the reception of Baudelaire and his immediate successors in England and in the United States; the reception of Rilke in France and in England; the reception of T.S. Eliot in the United States, England and France; and the reception of Cavafy in England. Poetry of the receiving cultures will be examined as evidence of the implied perception of the work received.

Prerequisite: Permission of the committee.

A.T. Tolley.

- Comparative Literature 17.593F2, W2, S2

Comprehensives

- Comparative Literature 17.595F1½, W1½

Study Abroad

Under the terms of the accord with l'Université de Picardie at Amiens, students may do a part of their work for the M.A. in Comparative Literature at Amiens. The content of the study will be decided by the Comparative Literature Committee at Carleton. Only students sponsored by the Committee under the exchange may take this course. Work done at Amiens will be the subject of a report from l'Université de Picardie and will receive a final grade awarded by the Comparative Literature Committee at Carleton.

Prerequisite: Permission of the committee.

- Comparative Literature 17.596T2

Directed Special Studies

From time to time, students whose main interests are not covered by courses offered in a given year may pursue independent research, subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply to the supervisor of graduate studies.

- Comparative Literature 17.598F1, W1, S1

Directed Special Studies

From time to time, students whose main interests are not covered by courses offered in a given year may pursue independent research, subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply directly to the supervisor of graduate studies.

- Comparative Literature 17.599F4, W4, S4

M.A. Thesis

Courses Not Offered in 1989-90

- 17.507 Study of Theme and Motif
- 17.510 Special Topic in Fiction
- 17.520 Intertextuality
- 17.527 Cross Cultural Studies
- 17.590 Seminar in Comparative Literature

Department of English Language and Literature

Dunton Tower 1812
788-2310

The Department

Chair of the Department: Robert Laird
Departmental Supervisor of Graduate Studies:
M.J. Edwards

The Department of English offers programs of study leading to the M.A. degree in English Language and Literature. Additional information may be obtained by consulting the departmental supervisor of graduate studies.

Qualifying-Year Program

Applicants who hold a general (pass) B.A. degree with at least B standing, with a major in English language and literature, may be admitted to the qualifying-year program. Normally, these students will be required to complete four or five full courses (or the equivalent) in English, as determined by the department, and to maintain at least high honours standing before being considered for admission into the master's program.

Master of Arts

Admission Requirements

The minimum admission requirement for the master's program is an honours B.A. (or the equivalent) in English Language and Literature, with at least high honours standing, and including at least five of the following areas:

- History of the English Language or General English Linguistics
- Old English or Middle English
- Renaissance Literature
- Drama (including Shakespeare)
- Restoration and Eighteenth-Century Literature
- Romantic and Nineteenth-Century Literature
- Twentieth-Century Literature
- Canadian Literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Program Requirements

Each candidate will select one of the following optional program patterns:

- Two credits in English, selected from those at the 500 level (excluding English 18.597 and English

18.598), plus English 18.501, Bibliography and Scholarly Methods, and a master's thesis; an oral examination on the thesis will be required. A prospectus for the thesis must be submitted to the Graduate Committee by December 1 after registration in September, or at the end of three months for any other registration.

- Three credits in English selected from those at the 500 level, plus English 18.501, Bibliography and Scholarly Methods, and a research essay; an oral examination on the research essay will be required.

Each program is designed to be completed within the three-term academic year. Each program is of equal status.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the department.

Compulsory Course in Bibliography and Scholarly Methods

English 18.501 is a compulsory half-credit course for all students in the M.A. program. The material covered will include the use of standard reference works and bibliographies, documentation, research methods, and an introduction to the problems of textual editing and textual criticism. Students will complete practical exercises related to their chosen field of research.

Academic Standing

A standing of B- or better must be obtained in each course counted towards the master's degree.

Graduate Courses*

- English 18.500F1

Literary Criticism

A study of specific topics or particular areas of literary criticism.

- English 18.501F1

Bibliography and Scholarly Methods

An introduction to the methodology of research in English studies.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- English 18.534W1

Renaissance Drama

A study of selected Renaissance plays.

- English 18.553W1

Nineteenth-Century Fiction

A study of selected Victorian writers.

- English 18.561W1

Twentieth-Century Poetry

A study of selected twentieth-century poets.

- English 18.563T2

Twentieth-Century Fiction

A study of selected twentieth-century writers.

- English 18.568S1

Twentieth-Century Studies

A study of selected British fiction.

- English 18.576W1

American Literature

A study of selected American authors.

- English 18.581F1

Canadian Poetry

A study of selected Canadian poets.

- English 18.583T2

Canadian Fiction

A study of selected Canadian writers.

- English 18.588S1

Studies in Canadian Literature

A study of selected Canadian authors.

- English 18.597F1, W1, S1

Directed Special Studies

All students in the M.A. course program will be assigned to a supervisor for tutorials in the area of their research essay.

- English 18.598F1, W1, S1

Research Essay

- English 18.599F4, W4, S4

M.A. Thesis

- English 18.699F10, W10, S10

Ph.D. Thesis

Undergraduate Courses*

Graduate students may take *one* of their courses at the senior undergraduate level.

*This is not a complete list of all the acceptable options. Students should contact the supervisor of graduate studies or the chair for approval if there are other courses they wish to take which are not on this list.

Other Disciplines

Graduate students may take *one* of their five courses in a related discipline. The following courses may be among those of special interest:*

Comparative Literature

- 17.401 Foundations of Comparative Literature
- 17.402 Theories of Literature
- 17.501 Methods of Analysis in Literary Studies I
- 17.502 Methods of Analysis in Literary Studies II
- 17.506 Styles and Periods: Women Writers between World War I and World War II
- 17.525 Literary Movements in the Nineteenth and Twentieth Centuries

Other Universities

Graduate students may take up to *two* of their five credits at another university or other universities and receive credit towards a Carleton M.A.. Students are especially reminded that the University of Ottawa offers a wide range of graduate courses which may be completed (under the general two-credit ruling) for credit at Carleton.

Courses Not Offered in 1989-90

- 18.518 Old Norse
- 18.521 Middle-English Poetry
- 18.522 Middle English
- 18.527 Selected Medieval Authors
- 18.528 Middle-English Studies
- 18.531 Renaissance Poetry
- 18.532 Seventeenth-Century Poetry
- 18.537 Renaissance Authors
- 18.538 Renaissance Studies
- 18.542 Eighteenth-Century Prose and Poetry
- 18.543 The Eighteenth-Century Novel
- 18.548 Studies in Romanticism
- 18.551 Nineteenth-Century Poetry
- 18.558 Nineteenth-Century Literature
- 18.564 Twentieth-Century Drama
- 18.566 Twentieth-Century Literature
- 18.567 Twentieth-Century Authors
- 18.571 American Poetry
- 18.573 American Fiction
- 18.578 Studies in American Fiction
- 18.585 Canadian English
- 18.587 Selected Topic in Canadian Literature
- 18.590 Selected Topic
- 18.591 Selected Topic
- 18.592 Cross Cultural Studies: Literature Written in the English Language
- 18.594 Special Studies in Dramatic Literature

Department of Film Studies

St. Patrick's Building 427

788-5606

The Department

Chair of the Department: George McKnight

The department does not offer a program of studies at the graduate level, but does offer a course at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

- Film Studies 19.528T2

Canadian Cinema

Through a close analysis of films from both cultures, this course should establish the distinctly Canadian modes our cinema has developed.

Special attention will be paid to the similarities and differences between English Canada and Québec, relating them both to the economic and political realities of our country, and to the variety of thematic orderings of Canadian culture that can be found in writers like Northrop Frye and Margaret Atwood.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of French

Dunton Tower 1602
788-2168

The Department

Chair of the Department: Juliette Kealey
Departmental Supervisor of Graduate Studies:
J.-J. van Vlasselaer

The program of studies leading to a Master of Arts degree in French consists of courses (one-half credit each) covering the fields of French linguistics, linguistic analysis of literary discourse, literary history and literary criticism. The availability of a great variety of courses and the existence of 20.580, 20.590 and 20.599, in which the student establishes course content in consultation with his/her adviser allow for considerable flexibility and choice in wide ranging or highly specialized studies.

Qualifying-Year Program

Applicants who hold a general (pass) bachelor's degree with at least B standing or higher, with a major in French, will be required to register in the qualifying-year program (normally five courses in French chosen from those numbered at the 400 level), and maintain at least B+ standing overall, before proceeding to the M.A. program.

Qualifying-year students should consult the undergraduate calendar for a listing of 400-level courses.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an honours B.A. in French with at least high honours standing (normally B+ or better in honours subject; B- or better overall).

Program Requirements

Students will establish their programs in consultation with an adviser from the department who will normally be the professor with whom they are taking 20.590: Etudes dirigées, or 20.599: M.A. thesis, which are requirements.

The following two patterns are available:

- Four credits, of which at least three must be chosen from courses at the 500 level; and a directed special studies option (20.590), with an oral examination
- Three credits, of which at least two must be chosen from courses at the 500 level; and a master's thesis

equivalent to two credits (20.599), with an oral examination.

With the approval of the department, master's students in French may select a comparative literature course in partial fulfilment of their program requirements.

Academic Standing

A grade of at least B- must be obtained in each course counted for credit towards the master's degree.

Graduate Courses*

The graduate courses offered by the department are open to students in the M.A. program and, with permission of the department, to students in the qualifying-year program. For prerequisites, please consult the department.

- French 20.502F1
Linguistique du français I
T.B.A.

- French 20.503W1
Linguistique du français II
Etude linguistique et stylistique dans l'acte de communication et dans le discours littéraire. Analyse des procédés de l'expression. Fonctions communicatives, esthétiques, artistiques et pragmatiques des discours. Textes écrits et oraux choisis dans différents domaines culturels.
P. Laurette.

- French 20.504W1
Linguistique du français canadien
Problèmes de phonétique en français canadien. Variantes combinatoires, sociales et régionales des phonèmes de la langue. Effet de la phonétique sur les niveaux morphologiques, syntaxiques et lexicaux. Transcription de textes oraux authentiques. Analyse et discussion d'études déjà parues.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• French 20.506F1

Linguistique du français langue seconde

Etude des éléments linguistiques (en phonologie, morphosyntaxe et sémantique), constitutifs de la compétence de communication. Leur place dans les processus de conceptualisation linguistique.

J.J. van Vlasselaer.

• French 507W1

Traduction: théorie et pratique

Poésie et traduction. Après une introduction théorique, exercices pratiques de traduction de textes poétiques de l'anglais vers le français (poètes canadiens-anglais et poètes anglophones) et du français vers l'anglais (poètes du Québec et de la francophonie). (Cours 17.505 offert par le Comparative Literature Committee).

E. Voldeng.

• French 20.541F1

Sémiotique littéraire

Sémiologie du geste théâtral. Etudes des scènes filmées tirées de pièces de Molière, Marivaux, Diderot, Sartre, et d'une représentation théâtrale canadienne-française contemporaine. (Cours 17.508 offert par le Comparative Literature Committee).

S. Sarkany.

• French 20.542W1

Théories générales de la littérature

Les thèmes esthétiques et leur application à la littérature. Etude des genres littéraires et des principaux manifestes. Auteurs: La Pleiade, Boileau, Mme De Staël, Hegel, Taine, Mallarmé, Breton.

P. van Ruten.

• French 20.543W1

Littérature et idéologie

Le roman idéologique moderne. Oeuvres de référence: *La Rhétorique* d'Aristote et le *Traité de l'argumentation* de Perelman. Auteurs: A. France, A. Camus, A. Malraux.

A.W. Halsall.

• French 20.544F1

Auteur

Montaigne: *Essais* (Livre III). Définition de la pensée de Montaigne: ses idées morales, religieuses, politiques. Analyse de l'art de l'écrivain: la technique littéraire des *Essais* (structure, langue, images).

P. Clive.

• French 20.545F1

Thèmes, écoles, mouvements

Avant-gardes et manifestes dans la francophonie du 20^e siècle. (Cours 17.530 offert par le Comparative Literature Committee).

P. Laurette.

• French 20.546W1

Genres I

Discours autoréférentiel: le Nouveau Roman des années 50.

Après la littérature engagée des existentialistes - discours référentiel par définition - vient le discours autoréférentiel des Nouveaux Romanciers. Par une étude de certains textes romanesques et théoriques, ce cours essaiera de mettre en lumière la notion d'autoréférentialité ainsi que ses implications formelles, idéologiques, et ses liens avec l'avant-garde et avec la critique dite moderne. Au programme: R. Bathes, M. Butor, J. Ricardou, A. Robbe-Grillet, N. Sarraute.

E. Zimmerman.

• French 20.547F*

Genres II

T.B.A.

• French 20.548F1

Littérature française I

Etude comparative de l'oeuvre de François Villon et de Charles d'Orléans

J. Miquet.

• French 20.549W1

Littérature française II

T.B.A.

• French 20.550F1

Littérature canadienne-française I

La pensée sociale, politique et spirituelle de Gabrielle Roy.

P. Smart.

• French 20.551W1

Littérature canadienne-française II

La prose d'idées au Canada français. Evolution et expression d'une pensée distinctive au Canada français.

M. Gaulin.

• French 20.562W1

Littérature, société, communication

Sociologie des écrivains. La profession d'écrivain. Exploration des rapports entre conditions institutionnelles et ambiances d'une part, et ambitions et réalisations intellectuelles et artistiques d'autre part. Auteurs: Proust, Larbaud, Morand, Aveline, Fréchette, Godbout, Perrault. Théoriciens: Chamboredon, Escarpit, Bourdieu, Dubois. (Cours 17.530 offert par le Comparative Literature Committee).

S. Sarkany.

- French 20.570W1

Aspect littéraire culturel particulier

La pensée sociale d'Hubert Aquin telle qu'elle se révèle dans son oeuvre romanesque. Oeuvres: tous les romans d'Hubert Aquin, *Blocs erratiques*, ouvrages biographiques et critiques, films consacrés à l'auteur.

P. Smart.

- French 20.580F1, W1, S1

Tutorial

Sujet établi sur proposition de l'étudiant en consultation avec son conseiller.

- French 20.590T2, S2

Etudes dirigées

Tout(e) étudiant(e) qui ne fait pas de thèse, choisira un directeur d'études avec qui il/elle préparera un mémoire d'une cinquantaine de pages sur un sujet de son choix. Ce travail sera sanctionné par un examen oral.

- French 20.599F4, W4, S4

M.A. Thesis.

Courses Not Offered in 1989-90

20.501	Théories linguistiques françaises
20.505	Linguistique textuelle
20.520	Aspect linguistique particulier
20.561	Sémiotique culturelle
20.563	Littérature et les autres arts
20.564	Paralittératures

Department of German

Dunton Tower 1315

788-2115

The Department

Chair of the Department: Arnd Bohm

Departmental Supervisor of Graduate Studies:

Arnd Bohm

The Department of German offers programs of study leading to the degree of Master of Arts. Where German literature is to have the chief emphasis, courses are available on the major periods of German literary history, on specific genres, themes, and a number of individual authors, as well as on aspects of literary theory and the study of the German language. The Age of Goethe figures prominently in the teaching and research of the department, which offers a favourable setting for specialized studies in this period.

Alternative course pattern. Students may also select instead a program which emphasizes areas of the linguistics of present-day German and the relationships between society and works of the creative imagination.

Admission Requirements

Departmental requirements conform to those outlined for master's students in the general section of this calendar. Further information concerning graduate work in German may be obtained from the department.

Program Requirements

Master's students in German electing the course pattern emphasizing literature normally will be required to select and follow one of the following optional program patterns:

- Three full courses (or the equivalent) and a thesis
- Four full courses (or the equivalent) and a research essay
- Five full courses, or the equivalent.

While these courses will normally be courses offered by the department, permission, where appropriate, may be granted for enrolment in one course from the program of the Comparative Literature Committee.

German 22.590 is an obligatory course for all graduate students electing this course pattern (full-course credit).

All master's students choosing the literature course pattern are also required to undertake a comprehensive examination, based on a departmental reading list of selected texts by major authors.

Any student who has completed all degree requirements except the comprehensive examination should enrol in German 22.592 for the semester in which the examination is to take place.

Master's students in German electing the alternative course pattern will normally choose to do either:

- Three full courses (or the equivalent) and a thesis to be focused on the pedagogy of the German language or of German literature or
- Four full courses (or the equivalent) and a research essay to be focused on the pedagogy of the German language or of German literature.
- As preparation for the thesis or the research essay students are required to take, in turn, two practica, on language teaching and the teaching of literature respectively.

Graduate Courses*

The following is a list of all German courses at the graduate level. Please note that *not all* courses are offered *every* year. Students should consult the university and departmental timetables published early in July for a list of courses offered in 1989-90 and their scheduling.

- German 22.541F1 or W1
Genres in German Literature
Formen der Kurzprosa: R. Walser, Kafka, Musil, Brecht, Eich, Bobrowski, Kunze, Fried. Basil Mogridge.

- German 22.562F1 or W1
Period Studies
Die Literatursprache des 20. Jahrhunderts in diachronischer Sicht. Narrativer Stil in Werken von Döblin, Kafka, Thomas Mann, Grass, Christa Wolf. Jutta Goheen.

- German 22.568F1 or W1
Period Studies
Moderne Lyrik: Die hermetische Tradition von Rilke bis Atabay. Arnd Bohm.

- German 22.582F1 or W1
Linguistic Problems
Mittelalterliches Deutsch: Kennzeichen der mittelhochdeutschen Literatursprache: Morphologische, syntaktische und semantische Eigenheiten. Texte: Nibelungenlied, Minnesang. Jutta Goheen.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- German 22.590T2

Directed Studies

Wege der Literaturgeschichte. Die Entwicklung der deutschen Literatur vom Hohen Mittelalter zum 20. Jahrhundert. Untersuchung ausgewählter Texte sowie theoretische Betrachtungen zur deutschen Literaturgeschichte.

- German 22.591F1, W1, S1

Special Topic

Tutorial.

- German 22.592F, W, S

Comprehensive Examination

- German 22.598F2, W2, S2

Research Essay

- German 22.599F4, W4, S4

M.A. Thesis

Other Courses

See the undergraduate calendar for courses at the 400-level which are open, with the approval of the department, to students in the qualifying-year program and (under the usual restrictions) to master's students.

Courses Not Offered in 1989-90

Genres in German Literature

22.540 Das historische Drama

22.542 The emblematic tradition

22.543 Novelle des 19. Jahrhunderts

22.545 The novel as a reflection of World War II

22.547 Variations on the novel. Genre, structure, style

22.548 Deutsche Erzählprosa zwischen Reformation und Aufklärung

22.549 Semiotik des Dramas

Prevalent Themes in German Literature

22.550 Myth in drama

22.551 Höfische Dichtung des Barock

Period Studies

22.560 Mittelalterlicher Stil

22.561 Drama in the nineteenth century

22.563 Sozialgeschichte und Literaturgeschichte des Mittelalters

22.564 Aufklärung: Ideale und Projekte 1740-1790

22.565 Rhetorik in mittelalterlicher Dichtung

22.566 Prominent works of the fifteenth and sixteenth centuries

22.567 Romantische Dichtung

22.569 Naturlyrik der Aufklärung

Individual Authors

22.571 Goethe im frühen 19. Jahrhundert

22.574 Goethe's early dramas

22.575 Keller

22.576 Grimmelshausens *Simplicissimus*22.577 *Faust II*

22.578 Fontane's novels: Social criticism and humour

Linguistic Problems

22.583 Sprachwandel im Neuhochdeutschen

22.584 Der deutsche Satz

Department of History

Paterson Hall 400
788-2824

The Department

Chair of the Department: R. C. Elwood
Departmental Supervisor of Graduate Studies:
A.B. McKillop
Associate Supervisor: R.A. Jones

The Department of History offers programs of study leading to the degree of Master of Arts in Canadian, American, British, Modern French, Modern Russian, International (diplomatic), and Medieval History. It also offers a program of study and research leading to the degree of Doctor of Philosophy in Canadian History.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours bachelor's degree (or the equivalent) with at least high honours standing.

The department offers no qualifying-year program; applicants with a general (pass) degree may be considered for admission into the fourth year of Carleton's honours B.A. program.

Program Requirements

Candidates may follow either a thesis or a non-thesis program, as follows:

- History 24.588 or 24.589:
a seminar or tutorial in the historiography of the appropriate country or area (one credit)
- History 24.500:
a practicum in the applied uses of history (one credit)
- a graduate history seminar in the student's major field of concentration (one credit)
- *Either* History 24.599:
thesis (two credits); *or*
- History 24.598:
research essay (one credit) *plus* one additional seminar (one credit), which may be chosen from those offered at the graduate or 400 level by the Department of History, by another department at Carleton University, or by the Department of History at the University of Ottawa.
- M.A. students are required to submit thesis/research essay proposals to the graduate supervisor early in their second term of full time enrolment.

Language Requirements

All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For seminars dealing with sources not in English, a reading knowledge of the appropriate language will be required *before* acceptance into the program. Details may be obtained from the supervisor of graduate studies.

Doctor of Philosophy

Admission Requirements

Applicants with an M.A. degree will be expected to have at least high honours standing.

An applicant with an honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Residence Requirements

- A minimum of three years of full-time study after the B.A. honours degree, or two years after the M.A.

Program Requirements

Candidates will be responsible for three fields: a major field (Canadian history) and two minor fields. At least one of the minor fields must concern American, British, French, Russian or International history. The other may be a trans-national topic or in a related discipline. In each instance, the minor field should cover approximately one century. Written examinations will be taken in the two minor fields before the end of the student's second term of study; an oral examination in Canadian history will be arranged during the student's fourth term. Ph.D. candidates are required to submit a thesis proposal to the graduate supervisor within *three* months of completing their comprehensive exams.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year, and before the candidate is permitted to take the doctoral field examinations. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the program with an honours B.A. will normally complete

- History 24.588: Historiography of Canada
- History 24.591: Directed Studies in a Canadian Field.

- History 24.592: Directed Studies in a Non-Canadian Field
- and two other graduate seminars in their first year.

Students entering the second year (that is, the first post-M.A. year) will normally be required to follow

- History 24.688: Social History
- History 24.690: Preparation for a Ph.D. oral examination in Canadian history (equivalent to two full credits)

- Two of

History 24.610: Directed Studies in an Aspect of Modern European History; History 24.640: Directed Studies in United States History; History 24.650: Directed Studies in British History; an approved course of studies in a related discipline appropriate to the candidate's field. Candidates may take an appropriate 500-level seminar.

With other requirements completed, doctoral students will be required to write a thesis on a topic related to Canadian history (five credits).

University of Ottawa

A Carleton University student may take one seminar in the Department of History at the University of Ottawa, with permission of the two departments.

Graduate Courses*

Most, but not all of the graduate seminars (History 24.500 through 24.588 and 24.688) are offered each year, but none is available during the summer. The directed studies and thesis courses (History 24.589 through 24.690) are always offered during the academic year, and are frequently available during the spring and summer terms as well.

Admission to History graduate seminars is normally restricted to graduate students in the department and to others who have successfully completed two full upper-level undergraduate History courses or the equivalent in the general area of the seminar, or who have received permission of the department.

- History 24.500T2
Practicum in Applied History
Study of the practical uses of history in such fields as archival management, museum research, oral history, journal editing, quantitative investigations, and contract research.
D.A. Muise and members of the department.
- History 24.502T2
Beginnings of Early Medieval Europe and Near East
Transformation of the later Roman world into the

polities of early Medieval Europe and Near East. Not open to students who have completed either 24.402 or 13.402.

Roger Blockley.

- History 24.505T2
Law and Society in Medieval England
J.G. Bellamy.

- History 24.516T2
The French Revolution, 1788-1804
A sound reading knowledge of French is required for admission.

- History 24.525T2
Society and Culture in Canada, 1850-1939
Changes to the structure and values of Canadian societies and their cultures in the period of urban-industrial transition.
Members of the department.

- History 24.530T2
Canadian Immigration and Ethnic History
Historical development of immigration to Canada and its ethnic relations in the nineteenth and twentieth centuries. Not open to students who have completed 24.424.
M.J. Barber.

- History 24.531T2
French Canada since Confederation
A study of topics relating to the political and social history of French Canada and to problems of cultural duality.
H.B. Neatby.

- History 24.532T2
Ontario in the Nineteenth Century
J.K. Johnson.

- History 24.533T2
Intellectual History of Canada
An intensive examination of selected aspects of Canadian thought from the early nineteenth century to the present.
A.B. McKillop.

- History 24.534T2
Problems of Growth and War in Canada, 1896-1921
D.L. McDowall.

- History 24.535T2
Canada in the World, 1900-1949
An examination of Canada's changing relationships in the world community.
G.N. Hillmer.

- History 24.536T2
Science and Technology in the Canadian Experience
An examination of the role and relationship of science and technology, including their social and engineering applications, in the Canadian historical experience. Not open to students who have completed 24.421.
J.H. Taylor.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- History 24.537T2

The Maritimes in Transition, 1840's to 1890's

A seminar on social and economic themes. Not open to students who have completed 24.422.

D.A. Muise and B.C. Bickerton.

- History 24.538T2

The Indian Peoples of Northern Canada

An ethnohistorical approach to the study of selected issues in the history of the aboriginal peoples of the subarctic. Not open to students who have completed 24.423.

Kerry Abel.

- History 24.539T2

Acadian and Quebec Society before 1763

An examination of the main political and social developments in both communities with attention being paid to the history of France during the same period. N.E.S. Griffiths.

- History 24.540T2

The Age of the American Revolution, 1730-1815

P.J. King.

- History 24.550T2

Selected Problems in the Political Economy of Canadian Labour

A study of selected aspects in the history of Canadian labour with emphasis on the dynamics of social, economic, political and cultural change in twentieth century Canada. Not open to students who have completed 24.425.

F.J.K. Griezic.

- History 24.557T2

Community in Early Modern England, 1450-1600

R.B. Goheen.

- History 24.558T2

Reform and Society in Mid-Nineteenth-Century Britain

Deborah Gorham.

- History 24.559T2

Women in Nineteenth- and Twentieth-Century North America and Britain

An examination of the role and image of women in the context of social and economic development and of the family in North America and Britain.

M.J. Barber and Deborah Gorham.

- History 24.560T2

Revolutionary Russia, 1898-1921

An examination of various primary sources available for research on revolutionary Russia.

A sound reading knowledge of Russian is required for admission.

R.C. Elwood.

- History 24.580T2

Problems in International History

J.L. Black or R.A. Jones.

- History 24.588T2

Historiography of Canada

A seminar, primarily for graduate students in Canadian history, which examines the trends and methods of Canadian historical writing, and the influences upon it.

S.R. Mealing.

- History 24.589F2, W2, S2

Historiography

A course of directed studies in one of the following fields:

Modern France

The intensive study of selected problems in the writing of modern French political and social history.

Britain

The intensive study of a range of selected problems in the writing of sixteenth-century or nineteenth-century English history.

R.B. Goheen or Deborah Gorham.

Modern Russia

Concentrated reading in Russian intellectual history and supervised study of Russian historiography, with emphasis on the nineteenth and early twentieth centuries.

R.C. Elwood and J.W. Strong.

United States

A course in which the trends and methods of historical writing on the United States will be examined.

P.J. King.

International History

A course in which the trends and methods of historical writing on international history will be examined.

J.L. Black and R.A. Jones.

Medieval History

Historical method and historiography of an aspect of the Middle Ages.

J.G. Bellamy.

- History 24.591T2, S2

Directed Studies in a Canadian Field

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

- History 24.592T2, S2

Directed Studies in a Non-Canadian Field (same description as 24.591)

- History 24.593F1, W1, S1

Directed Studies in a Canadian Field (same description as 24.591)

- History 24.594F1, W1, S1

Directed Studies in a Non-Canadian Field (same description as 24.591)

- History 24.598F2, W2, S2

M.A. Research Essay

An examination of an approved topic in Canadian, American, British, modern French, modern Russian, international, or medieval history.

- History 24.599F4, W4, S4

M.A. Thesis

A substantial historical investigation. The subject will be determined in consultation with the department, and a supervisor will be assigned.

The candidate will be examined orally after presenting his/her thesis.

- History 24.610T2, S2

Directed studies in one of the following aspects of modern European history: modern France, modern Russia (R.C. Elwood and J.W. Strong), and international history (J.L. Black and R.A. Jones).

- History 24.640T2, S2

Directed Studies in United States History

P.J. King.

- History 24.650T2, S2

Directed Studies in British History

Deborah Gorham or R.B. Goheen.

- History 24.688T2

Social History

A course, primarily for doctoral candidates in history, in which the literature and methodology of basic aspects of social history will be examined.

R.B. Goheen and members of the department.

- History 24.690F4, W4, S4

Directed Studies in Canadian History

A program of supervised reading with several instructors in preparation for the Ph.D. oral examination.

- History 24.699F, W, S

Ph.D. Thesis

School of Journalism

St. Patrick's Building 346
788-7404

The School

Director of the School: Anthony Westell

Supervisor of Graduate Studies: Anthony Westell

The School of Journalism offers courses leading to the degree of Master of Journalism. The emphasis in the M.J. program is on advanced professional education for those who are or intend to become practising journalists in the news media. In practical terms, this entails both the polishing of professional journalistic skills to a high level of proficiency and advanced education in a related field of study. Provision is made also for students who wish to undertake research in journalism and mass media.

Following a common first year of professional coursework, students in the master's program will choose one of three areas of concentration in their second year of study:

Specialized Print Reporting

At present specializations are offered in the fields of politics/public administration, international affairs and economics/business. Others may be added as resources come available.

Television Journalism

The focus of this specialty will be the study of advanced techniques in reporting, writing and producing television journalism programs.

Journalism Studies

This program is designed for applicants who have mastered the skills of reporting and writing for the news media but who wish to spend a year studying their craft and/or the news industry. This specialty encompasses a number of topics, which include the role of the media in society as it is conceived by selected social and political theorists, communications law, politics and the media, the economics of the media and journalism history.

Carleton's School of Journalism is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labour organizations, and major economic and cultural institutions.

Master of Journalism

Admission Requirements

The Master of Journalism program comprises 21 half-courses (or the equivalent). Most applicants will be

admitted to the first year of a two-year course of study, but some may qualify for admission directly to the second year (see below). An admissions committee, including the Supervisor of Graduate Studies, will determine the admissions qualifications of each applicant.

Admission will be selective. Admission will not be guaranteed to all who meet the published minimum requirements, as there are many more qualified applicants each year than there are available spaces.

A student who holds a bachelor's or master's degree from a recognized university in a field other than journalism may be admitted to the first year of study if he or she achieved at least high honours standing. Such students who complete the core first year, outlined below, and meet the requirements of the Faculty of Graduate Studies (see p. 12) may proceed to second year. However, candidates must have earned at least B in each of their reporting courses.

Applicants who have three-year (pass) journalism degrees with high honours standing may be admitted to a first year made up largely of approved courses from the Faculties of Arts and Social Sciences. Such students may proceed to the second year of study if they have achieved high honours standing.

A limited number of spaces will be made available for direct admission to the second year of the M.J. program. Students must normally possess one of the following qualifications to be considered for this advanced admission: a B.J. (Hons.) or equivalent with high second-class standing, *or* a degree in another discipline from a recognized university plus at least five years' professional experience in journalism, *or* long and distinguished professional experience in journalism. Students with suitable professional qualifications but no degree may occasionally be admitted to a program in which they take a required number of undergraduate courses in addition to the M.J. program.

Application is made on forms available from the School of Journalism. The University deadline for application is July 1, but students applying for the first year of the program are advised to apply by June 1 as enrolment in the School is limited. All applications received after June 1 will normally be considered only for entry into the program in the year following.

As a condition for graduation, all students are required to have a minimum of four months of practical experience in the media, and a working knowledge of a second language, preferably French.

Program Requirements

First Year

Candidates admitted to the first year of the Master of Journalism program must complete the following courses before proceeding to the second year of study:

- Journalism 28.500
- Journalism 28.520
- Journalism 28.522
- Journalism 28.524
- Journalism 28.535
- Journalism 28.536
- Journalism 28.541
- Journalism 28.321

First year M.J. candidates may be considered for advanced standing in certain of the above required courses, but in such cases will be required to replace waived courses with approved options.

Second Year

Credits will be determined according to the stream pursued:

Specialized Print Reporting

- (i) Journalism 28.560
- (ii) Journalism 28.570
- (iii) Journalism 28.575*
- (iv) Journalism 28.598*
- (v) At least one approved full course or two approved half-courses in the student's area of specialization.

*Under special circumstances, and with departmental approval, a student could replace items (iii) and (iv) above with a two-credit M.J. thesis, 28.599.

Television Journalism

- (i) Journalism 28.560
- (ii) Journalism 28.572
- (iii) Journalism 28.575*
- (iv) Journalism 28.598*
- (v) At least one approved full course or two approved half-courses in the student's area of specialization.

*Under special circumstances, and with departmental approval, a student could replace items (iii) and (iv) above with a two-credit M.J. thesis, 28.599.

Journalism Studies

- (i) Journalism 28.560
- (ii) At least one approved full course or equivalent in a field other than Journalism but related to the study of journalism (eg., 47.403*, 27.411, 27.431)
- (iii) One approved full course or equivalent from Journalism 28.580, 28.588, 28.589, 28.590, 28.591
- (iv) Journalism 28.599

Academic Standing

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the School and the

approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half-courses.

Full-time students in a 10½-credit M.J. program are advised that their thesis or research essay proposal must be formally approved within 18 months of initial registration. Students in a five-credit program must have the proposal formally approved by the middle of their second term of full-time registration. Due dates for part-time students will be adjusted accordingly. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of a thesis committee appointed by the Director of the School.

Students are advised to consult the general regulations section of this calendar for other regulations relating to academic standing.

Graduate Courses*

First Year:

- Journalism 28.500W1

Journalism and Society I

An examination of the conditions under which genuine communication is possible in a modern democratic society, with special attention to patterns of journalistic practice, media ownership and governmental regulation in Canada, Britain and the United States. Emphasis is placed on certain traditional texts as well as current research studies related to journalism and communication.

- Journalism 28.520F2

Print Journalism Laboratory

A laboratory course in basic reporting and editing techniques, followed by application in the print media.

- Journalism 28.522W2

Broadcast Journalism Laboratory

A laboratory course in reporting and editing in the broadcast media.

- Journalism 28.524W1

In-depth Reporting

Working in a small group under the close supervision of a faculty member, the student in this course develops skills in interpretative reporting through the preparation of in-depth newspaper articles or broadcast features. Where possible, students desiring to work on a particular public affairs topic are assigned to a supervisor with journalistic experience in that area.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Journalism 28.535F1

Perspectives on Modern Society

A seminar course examining texts from the social sciences, philosophy, literature and journalism for the contribution they make to an understanding of issues facing modern industrial society.

- Journalism 28.536T2

Public Issues

A seminar course examining literature and other sources in an attempt to understand continuing and emerging political, social and economic problems in Canada and elsewhere.

- Journalism 28.541F1

Journalism Law

The purpose of this course is to prepare journalists to function comfortably within the legal and ethical guidelines governing their occupation. The course also aims to help them avoid the large errors in reporting legal matters. Topics studied and discussed include: the difference between civil and criminal law; contempt of court; free press, fair trial; revealing of sources; civil defamation; criminal libel; obscenity; copyright; privacy; government secrecy; advertising law.

Second Year:

- Journalism 28.560T2

Journalism and Society II

This course involves an examination of the practices and problems of journalism, and of the role of journalism in modern society. Students will be asked to read texts in which journalists examine their craft and in which non-journalists analyze and comment on the manner in which journalism and communication systems are organized in modern society. The course seeks to integrate the analysis of journalism practice into general theories of media and society.

- Journalism 28.570T2

Specialized Print Reporting

This course attempts, through a combination of seminars and individual or small-group tutorials, to integrate advanced journalistic skills with knowledge gained in specialized areas such as politics, international affairs and economics. Students will study approaches to and problems in reporting in specialized areas, and work with senior professionals to research, report and write interpretive articles in those specialties.

- Journalism 28.572T2

Television Journalism

Students will be asked to analyze and, as resources permit, report, write and produce news and public affairs television programs.

- Journalism 28.575T2

Professional Practices

A senior seminar and practicum for second-year students in the specialized print reporting and television streams. Elements of the course include story analysis, publishing/broadcasting practices, ethical practices, management practices, language analysis, operation and practices of news services.

- Journalism 28.580W1

Survey Methods for Journalists

An examination of basic research design and data collection with emphasis on problems of interpretation.

- Journalism 28.588F1

Directed Readings

Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

- Journalism 28.589W1

Directed Research

Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

- Journalism 28.590T2, S2

Directed Studies

Reading and research tutorials.

- Journalism 28.591F1, W1, S1

Directed Studies

Reading and research tutorials.

- Journalism 28.598F2, W2, S2

M.J. Research Project

The student will complete a substantial piece of public affairs journalism in print or, if resources permit, in television; *or* a research project on the mass media; *or* a major contribution to journalism education through the production of a document on an aspect of journalism practice. Students in the specialized reporting stream will be expected to write on public affairs; television students will be expected to examine problems in television journalism or, if resources permit, may be given an opportunity to submit a completed work on film or video.

- Journalism 28.599F4, W4, S4

M.J. Thesis

To fulfill the requirements of this two-credit thesis course, students must produce a major piece of journalistic research or complete an academic thesis in the area of Journalism Studies.

Department of Linguistics

Paterson Hall 215
788-2802

The Department

Chair of the Department: Aviva Freedman

The Department of Linguistics does not offer a program at the graduate level, but does offer opportunity for independent study to students in the Institute of Canadian Studies and other departments in the areas of linguistic study of native languages of Canada, Canadian English and Canadian French dialectology, applications of linguistics in first-language education, and the teaching of English as a second language. Members of the department are also prepared to supervise graduate theses on linguistic subjects.

In co-operation with the Faculty of Graduate Studies and Research, the department publishes the papers of the annual Algonquian Conference.

- Linguistics 29.592F1, W1, S1

Tutorial in Applied Language Studies

A one-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

- Linguistics 29.598T2

Directed Studies in Applied Linguistics

A two-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

Graduate Courses*

- Linguistics 29.521S1

The Second Language Classroom

Research in second language classroom: methods for evaluating classroom practice and materials.

- Linguistics 29.522S1

Curriculum Design in ESL

Current theory and practice in ESL curriculum design in the light of recent research in linguistics, psycholinguistics, sociolinguistics and language acquisition studies.

- Linguistics 29.571F1, W1, S1

Linguistic Aspects of Canadian Bilingualism

The sociolinguistics and psycholinguistics of different kinds of bilingualism in Canada, with special emphasis on French-English bilingualism and English-heritage language bilingualism.

Prerequisite: Honours courses in linguistics or permission of the department.

- Linguistics 29.581F1, W1, S1

Native Languages of Canada

A tutorial to study the descriptive, historical, and anthropological aspects of selected native languages of Canada, among them Cree and Iroquois.

Prerequisite: Honours courses in linguistics or permission of the department.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Music

Loeb Building 911A
788-3733

The Department

Chair of the Department: Alan Gillmor

The Department of Music offers courses at the graduate level in the history of Canadian music and related fields, in co-operation with the Institute of Canadian Studies. Full use will be made of the resources of the National Library, the Public Archives, and the National Museum of Man.

Dr. Elaine Keillor is lecturer in Canadian music with Dr. Helmut Kallmann (former Chief Music Librarian, National Library) as Adjunct Professor.

Graduate Courses*

- Music 30.510T2

History of Canadian Music I

Selected aspects of Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian music; prerequisite: Permission of the department; cal life; regional studies; individual composers.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

- Music 30.511F1

History of Canadian Music II

Anglo- and Franco-folk music traditions in of Canadian Canada, past and present.

PreStudies.

- Music 30.512W1

History of Canadian Music III

The music of various ethnic minorities in Canada with special emphasis on Inuit and Indian traditions.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

- Music 30.515F1

History of Canadian Music IV

A survey of the history of French-Canadian popular music from the beginnings of Nouvelle France to the present. Topics to be covered include folklore music of the 17th, 18th and 19th centuries, salon music, political song, and the growth of mass disseminated popular music. Special attention will be paid to the social and political contexts of music making, in particular the identity of popular music with aspirations of nationalism in the Province of Québec during the 1950's, 1960's and 1970's.

Prerequisite: Permission of the department and the Institute of Canadian Studies. A good reading ability in French is essential.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Philosophy

Dunton Tower 2125
788-2110

The Department

Chair of the Department: Julian Wolfe
Departmental Supervisor of Graduate Studies:
J.A. Brook

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

Qualifying-Year Program

Applicants who do not hold an honours degree (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the general section of this calendar.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours B.A. degree (or the equivalent) in Philosophy, with at least B+ standing or the equivalent.

Qualifying-year and M.A. applicants from an institution other than Carleton University must submit two papers.

Program Requirements

The specific program requirements for master's candidates are the following:

- Philosophy 32.545, the departmental seminar
- A thesis equivalent to two full-course credits, which must be defended at an oral examination; or a research essay equivalent to one full-course credit
- Four half-course credits (or six in the case of students following the research essay option) in at least three of the following study areas: studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

Other Courses

A maximum of one full course (or the equivalent) may be selected from those offered at the 400 level, or in a related field, or at another university.

The department normally offers each year four 400-level undergraduate half-courses, which are open to students in the qualifying year and, with permission, to students in the M.A. program. For courses offered in 1988-89, please consult the undergraduate calendar.

Graduate Courses*

The following graduate courses are open to students in the M.A. program and, with permission, to students in the qualifying-year program. In tutorial courses, at least five two-hour tutorial sessions will be required.

- Philosophy 32.504F1
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of philosophy.
- Philosophy 32.505W1
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of philosophy.
- Philosophy 32.510F1
Advanced Problems in Legal Philosophy
Studies in legal theories and analyses of law advanced by Hart, Dworkin and others, and legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term.
Prerequisite: Philosophy 32.350 or Philosophy 32.311 and 32.312 (Law 51.311 and 51.312), or permission of the relevant department.
(Also offered as Law 51.510)
P.J. Fitzgerald and R.R.A. Marlin.
- Philosophy 32.514F1
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an individual philosopher.
- Philosophy 32.515W1
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an individual philosopher.
- Philosophy 32.524F1
Tutorial in Logic, Epistemology, or Metaphysics I
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.
- Philosophy 32.525W1
Tutorial in Logic, Epistemology, or Metaphysics II
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Philosophy 32.534F1

Tutorial in Selected Problems of Philosophy I

An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

- Philosophy 32.535W1

Tutorial in Selected Problems of Philosophy II

An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

- Philosophy 32.545T2

Departmental Seminar

Research papers to be given by faculty members and students.

- Philosophy 32.598F2, W2, S2

Research Essay

- Philosophy 32.599F4, W4, S4

M.A. Thesis

Department of Religion

Dunton Tower 2121

788-2100

The Department

Chair of the Department: L.T. Librande
Departmental Supervisor of Graduate Studies:
 John Dourley

The Department of Religion offers programs of study leading to the degree of Master of Arts.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours bachelor's degree in religion (or the equivalent) with at least high honours standing.

Applicants who do not hold an honours degree in religion (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the general section of this calendar.

Program Requirements

The student will choose a program of study concentrating on one of the following major areas: comparative religion, with special emphasis on one of the major traditions; biblical and ancient near eastern studies; and modern religious thought and culture. Candidates must follow either a thesis or non-thesis program. The specific requirements are as follows:

Thesis Program

- Seminars equivalent to one full course in major area
- Seminars equivalent to one full course, selected from one or both of the other areas
- Tutorial in major area for one-course credit
- Thesis (equivalent to two full courses) on a topic in major area, which must be defended at an oral examination.

Non-Thesis Program

- Seminars equivalent to three full courses; of these, at least two half-course seminars must be from the major area, at least two from a second area, and at least one from the remaining area.
- Comprehensive reading course in major area
- One additional course in major area.

The student's program will be worked out in consultation with, and with the approval of, the department's supervisor of graduate studies and its committee on graduate studies. The prescribed program will take into account the student's background and special interests, as well as the research interests and competence of the staff.

Deadlines

Thesis Proposal: In the case of the thesis program, full-time students will normally submit their thesis proposal to the thesis proposal board by the end of the first month of their second term in the M.A program.

Thesis: The candidate will inform the thesis supervisor two weeks in advance of the date on which he intends to submit copies of his thesis. The date of the defense will be set upon submission of the thesis and will take place no sooner than two weeks after the date of submission. This assumes a minimum of four weeks between the candidate's statement of intent and the defense

Language Requirements

The student will be required to acquire, or to demonstrate that he/she already has, a reading knowledge of whatever language is essential to his/her research.

Students are advised to consult the departmental handbook for further regulations.

Graduate Courses*

• Religion 34.510*

Seminar in Comparative Religion: The Institutionalization of Religion

This course will examine the concept of religiosity cross-culturally. The focus will be on the difference between individualized religions (shamanism and spirit quest) and organized religions (secret societies and totemism), and the process of institutionalization. (Also offered as Anthropology 54.587*)

John Cove.

• Religion 34.512T2, S2

Tutorial in Comparative Religion

• Religion 34.513F1, W1, S1

Directed Studies in Comparative Religion Seminar for additional study in this area.

• Religion 34.520F*

Seminar in Biblical and Ancient Near Eastern Studies: The Book of Acts - The Earliest History of Christianity. A study of the theology, historicity and purpose of the Acts of the Apostles.

• Religion 34.522T2, S2

Tutorial in Biblical and Ancient Near Eastern Studies

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Religion 34.523F1, W1, S1

Directed Studies in Biblical and Ancient Near Eastern Studies

Seminar for additional study in this area.

- Religion 34.530W*

Seminar in Modern Religious Thought and Culture: A Critical Theory of Religion

The course will examine the implications of the Frankfurt School's critical theory and sociology of religion for an understanding of religion and religious experience, within the wider context of recent theoretical approaches to the study of religion.

- Religion 34.532T2, S2

Tutorial in Modern Religious Thought and Culture

- Religion 34.533F1, W1, S1

Directed Studies in Modern Religious Thought and Culture

Seminar for additional study in this area.

- Religion 34.590T2, S2

M.A. Comprehensive Reading

Not open to students pursuing a thesis program.

- Religion 34.599F4, W4, S4

M.A. Thesis

Courses Not Offered in 1989-90

34.511 Seminar in Comparative Religion

34.520 Seminar in Biblical and Ancient Near Eastern Studies

34.530 Seminar in Modern Religious Thought and Culture

Department of Spanish

Dunton Tower 1419

788-2109

The Department

Chair of the Department: C.A. Marsden

Departmental Supervisor of Graduate Studies:

R.L. Jackson

The Department of Spanish offers a master's program, with specialization in either Peninsular or Spanish-American literature, or a combination of both.

All requests for more information concerning the program should be addressed to the departmental supervisor of graduate studies. The department will supply reading lists for individual courses and for the general comprehensive examination, and a brochure containing details of particular requirements and other information related to Spanish studies at Carleton.

Master of Arts

Admission Requirements

The requirements for admission to the master's program are outlined in the general section of this calendar.

Program Requirements

The minimum program requirements for master's candidates are stated in the general section.

The master's program may be undertaken in one of the following optional patterns:

- Three full courses (or the equivalent, not including 38.595), and a thesis equivalent to two full courses
- Five full courses (or the equivalent, not including 38.595).

The department also requires all students to undertake general comprehensive examinations, and to complete a non-credit tutorial on bibliography and research methods.

In certain circumstances, students wishing to study aspects of Hispanic literature not specifically offered by the department may enrol in Spanish 38.590 or 38.591: Directed Studies, if a specialist in the desired field is available.

All courses taken by graduate students shall be chosen in consultation with the department. From time to time certain courses offered by other departments may be accepted as part of the master's program in Spanish, and special arrangements may occasionally be made to undertake part of the program at universities in Spanish-speaking countries.

Ph.D. in Madrid for M.A. Graduates from Carleton

Students who complete their M.A. in Spanish at Carleton University will be able to register in the Ph.D. program in Spanish Literature at the Universidad Autonoma de Madrid under an exchange agreement between the two universities. Details of this program are available from the Chairman of the Department of Spanish and the Director of the Paterson Centre for International Programs.

Selection of Courses

The following senior undergraduate courses are open to students in the qualifying-year program and, with permission, to students in the M.A. program.

Spanish

- | | |
|--------|---|
| 38.402 | Theories of Literature |
| 38.415 | Medieval Spanish Literature from the Origins through 1300 |
| 38.416 | Medieval Spanish Literature, 1300-1500 |
| 38.420 | Cervantes |
| 38.430 | Modern Spanish Novel |
| 38.431 | Contemporary Spanish Novel |
| 38.435 | Modern Spanish Drama |
| 38.436 | Contemporary Spanish Drama |
| 38.440 | Modern Spanish Poetry |
| 38.441 | Contemporary Spanish Poetry |
| 38.460 | Twentieth Century Spanish-American Novel I |
| 38.461 | Twentieth Century Spanish-American Novel II |
| 38.470 | Twentieth Century Spanish-American Poetry I |
| 38.471 | Twentieth Century Spanish-American Poetry II |
| 38.490 | Seminar on a Special Topic |
| 38.491 | Seminar on a Special Topic |
| 38.492 | Special Studies |

Graduate Courses*

- Spanish 38.506F1

History of the Spanish Language II

Historical grammar of the Spanish language; synchronic and diachronic study of the phonetic, morphological, and syntactic structure of Spanish.

J. Jurado.

- Spanish 38.515W1

Special topic on Medieval Literature

Topic for 1989-90: Fourteenth-Century Narratives

Zifar, the works of Juan Manuel, Juan Ruiz and other authors. An analysis of their narrative structures, ideology and sociocultural context.

F.J. Hernández

- Spanish 38.520W1

Special Topic on Golden Age

Topic for 1989-90: Calderón

The study of selected *comedias* and *autos sacramentales* by Pedro Calderón de la Barca examining both his treatment of *honra* and the importance of the scenographic directions in the texts.

C.A. Marsden.

- Spanish 38.530F1

Problems of Modern Spanish Literature

At the time of going to press, the topic has not been decided. It is expected that under the terms of the Madrid-Carleton Agreement, a Visiting Professor from Madrid will be teaching in the area of contemporary Spanish poetry.

- Spanish 38.560F1

Aspects of Spanish-American Literature after 1888

Topic for 1989-90: Games and Play in Spanish-American Fiction

A study of the function of lexical and conceptual play, interior duplication of mythological and literary models, allegories, parodies, enigmas, doubles and other ludic devices in self-conscious Spanish-American narratives.

Ross Larson

- Spanish 38.570W1

Special Problems in Spanish-American Literature

Topic for 1989-90: The Concept of Humour in Twentieth Century Spanish-American Literature.

The study of various theories of humour (irony, the grotesque, farce, satire and comedy) and analysis of its stylistic and thematic manifestations in selected works of poetry, prose and theatre.

P.J. Toster.

- Spanish 38.570F1

Special Problems in Spanish-American Literature

Topic for 1989-90: Literature by writers of African Descent

The development of literary Blackness in Spanish America, with a focus on major Black authors in order to determine their racial, social, and literary significance.

R.L. Jackson.

- Spanish 38.590T2, S2

Directed Studies

- Spanish 38.591F1, W1, S1

Directed Studies

- Spanish 38.595F1, W1, S1

Directed Readings

Additional half-courses, designed in particular for students requiring special assistance in preparing for comprehensive examinations. Students are required to be enrolled in this course at the time of taking the examination.

- Spanish 38.599F, W, S

M.A. Thesis

Courses Not Offered in 1989-90

38.505 History of the Spanish Language I

38.525 Studies in Eighteenth Century Literature

38.550 Aspects of Spanish American Literature

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Departmental

Program

Descriptions

and

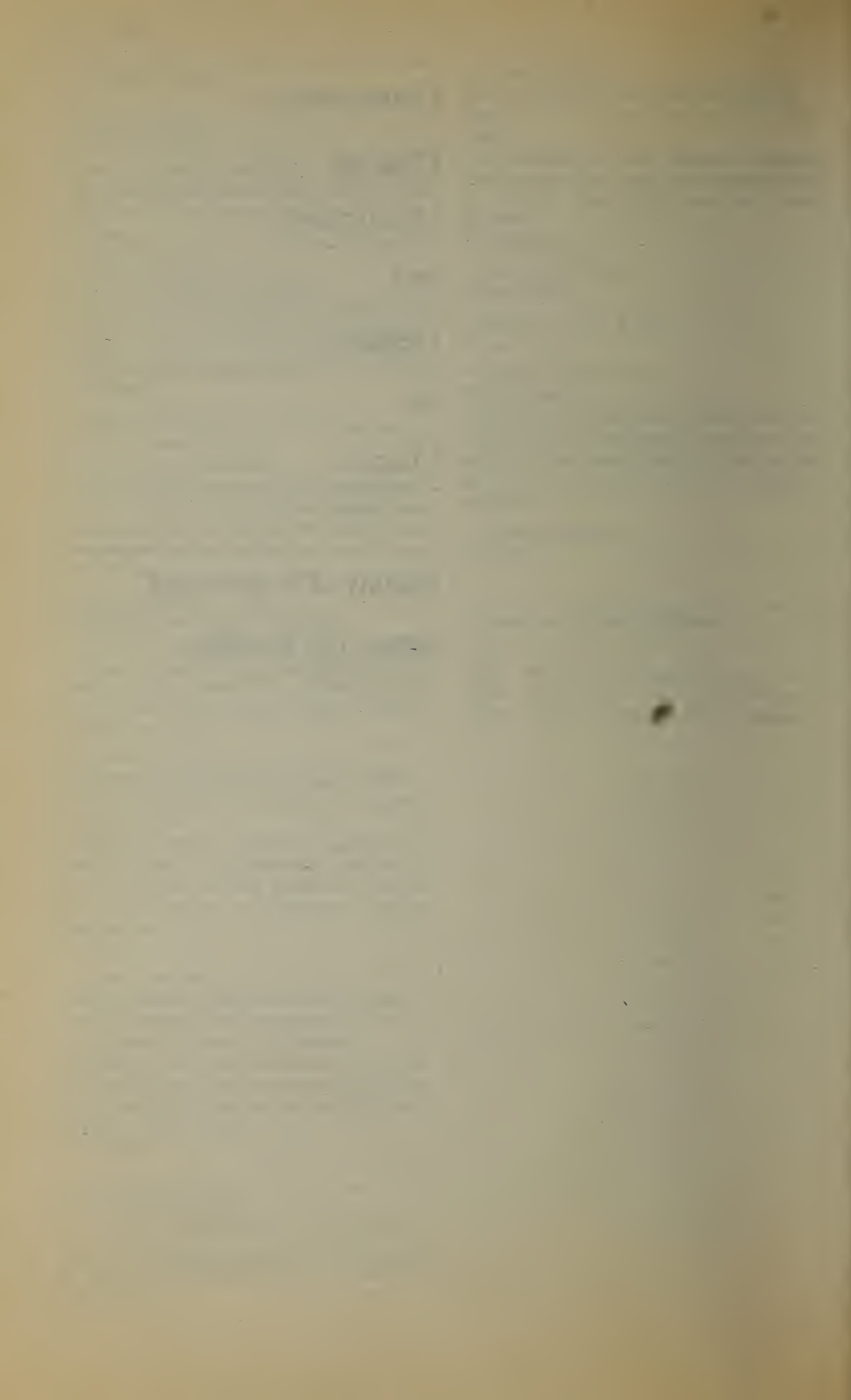
Details

of

Courses

Faculty of Engineering

Dean: J.S. Riordon



Engineering

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in Aeronautical, Civil, Electrical, and Mechanical Engineering, to the degree of Master of Engineering in Materials Engineering and, in co-operation with the Faculty of Science, to the degree of Master of Science in Information and Systems Science.

The graduate programs in each of the engineering departments at Carleton University and the University of Ottawa are administered through joint institutes in three engineering disciplines. The Ottawa-Carleton Institute for Electrical Engineering was established in 1983; and for Mechanical and Aeronautical Engineering, and for Civil Engineering in 1984. Each of these institutes combines the research strengths and resources of departments of engineering at Carleton and at the University of Ottawa, and provides a framework for interaction. The institutes are also concerned with applications for graduate programs and graduate course offerings. Programs leading to master's and Ph.D. degrees are available through the institutes in a wide range of sub-disciplines in each department.

The areas of current research, the research facilities available, and the graduate courses offered, are given in the following pages for the four departments of the faculty:

- Civil Engineering
- Electronics
- Mechanical and Aerospace Engineering
- Systems and Computer Engineering

Both the master's and Ph.D. programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in that section of this calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a special student normally cannot be credited towards a graduate degree in engineering.

Computing Facilities

Computing facilities available to engineering students include the University's central Honeywell mainframes with time-sharing terminals. Also two VAX minicomputers, several SUN and Apollo workstations, an FPS-164 attached processor and many microcomputers reside in the engineering departments. Several other computers within the faculty are in use for data acquisition and specific research projects.

Special Arrangements

Research in an Outside Institution

A student may apply for permission to carry out his/her research, in part or whole, in an outside institution (for example, industrial, governmental, or university laboratory). Such an application, addressed to the dean of Graduate Studies and Research through the dean of Engineering, should:

- Include a detailed statement of the research proposal, of arrangements for supervision, and of the circumstances under which it is to be carried out
- Establish that the applicant will be able to pursue independent research
- State the facilities available for the research
- Include a proposed time schedule
- Be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations.

Part-time Thesis Research

A part-time research program may be permitted if the conditions for the "presence" of the student (outlined under faculty regulations) are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can appropriately be credited to his/her program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the dean of Graduate Studies and Research through the dean of Engineering, a statement of his/her proposed manner of working part-time, supported by a letter of approval from his/her employer.

Waiver of Thesis

A candidate for the master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chairman of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration, and must be supported by copies of published reports describing the work. If the application is approved, the candidate must complete 10 half-courses or the equivalent, six of which must be graduate-level courses in engineering, to fulfil the requirement for the award of a degree without a thesis. A candidate who has been granted a waiver of the thesis requirement will be required to take an oral examination on the subject of one of his/her published papers and topics related to his/her field of specialization.

Transfer of Credit

Normally credit for one full graduate course completed at another university may be accepted in partial fulfillment of degree requirements, provided that the course is appropriate to the candidate's program at Carleton. Under special circumstances a second full course may be allowed. Refer to the general section of this calendar for details of the rules governing transfer of credit.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time master's program at Carleton may, subject to meeting the requirements below, and with the approval of the Admissions Committee of the Joint Institute administering his/her graduate program, be permitted to transfer into the Ph.D. program without receiving the master's degree. Such a student must complete the course requirements and thesis registration requirements of the master's program, but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chairman of his/her department. If the department and the Faculty of Graduate Studies and Research approve the application, the candidate will be required to take the comprehensive examination for the Ph.D. The requirements for the comprehensive examination will then include the submission of a report on research to date, and a research proposal for the Ph.D.

After successfully passing the comprehensive examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the comprehensive examination to his/her credit). If unsuccessful, he/she will remain in the master's program and be required to submit the thesis in the usual way.

Faculty Regulations

Graduate students in the Faculty of Engineering are governed by the section of this calendar entitled General Regulations, and by the regulations stated in this section.

All graduate students in the Faculty of Engineering must obtain satisfactory grades in their course work, must make satisfactory progress in their research if a thesis is included in their program, and must satisfy the following criteria of activity or "presence" in the program:

- Maintain a close working relationship with their research supervisor.
- Attend the courses for which they are registered.
- Submit written reports and present seminars as required by their supervisor.

- Attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his/her research; part-time students who are not actively engaged in research are exempt from the seminar requirement.

- Be readily available on an informal basis.

Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate studies at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off campus, provided that the work is approved in advance, and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of the thesis and related fields.

Registration and Course Selection

- Undergraduate engineering courses may not normally be taken for credit.
- All students require departmental approval for their program of studies, for course registration, and for any changes to their status or program.
- Each full-time student is required, in any fall or winter term in which he/she has outstanding program requirements of three or more half-courses, to register for credit in at least three half-courses. After the last day for withdrawal from courses in each such term, the student must remain registered in at least three half-courses.
- For part-time students, the department will arrange the appropriate course loading and selection.

Master of Engineering

Admission Requirements

Applicants are admitted under the general regulations specified in this calendar, but, in addition, are required to have strong undergraduate preparation in the appropriate engineering disciplines, computer programming, mathematics, and physics.

Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering, one involving a thesis plus course work, the other involving course work only. The choice of these alternatives must be arranged and approved at the time of admission into the program. Students are encouraged to take at least one half-course outside of their department.

M.Eng. by Thesis

- A thesis based on the student's research
- A minimum of six half-courses in engineering or a related discipline. The number of courses required by each department is specified in its section of this calendar.

M.Eng. by Course Work

Specific program requirements are detailed in the departmental sections of this calendar.

Doctor of Philosophy

Admission Requirements

For admission to the Ph.D. program, an applicant must normally hold a master's degree in engineering (or its equivalent) and, by his/her previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be taken into account when assessing an application. The applicant must specify his/her intended field of research.

Program Requirements

The specific program requirements for the Ph.D. degree are the following:

- A minimum of two calendar years of full-time study (or the equivalent)
- Course requirements as established on admission, but not less than six half-courses, or equivalent, in total (except in the Departments of Systems and Computer Engineering and of Electronics); these requirements must include at least four graduate level half-courses in engineering. Subject to approval of the student's adviser or advisory committee, the student may take, or be required to take courses in an appropriate discipline outside the Faculty of Engineering. (For information on admission and program requirements for the

Departments of Systems and Computer Engineering and of Electronics, please refer to pages 100 and 95 respectively.)

- Substantial research
- A thesis on the research.

Advisory Committee

An advisory committee with at least three members will be appointed by the department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of the student's program are fulfilled, and it reviews his/her progress at least once a year.

Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:

- To assess the student's comprehensive knowledge of his/her field of study
- To assess the preparedness and capability of the student for doctoral research
- To judge the suitability of the research topic for a doctoral thesis.

The student is required to present his/her research proposal, and to be subjected to oral and written examination in appropriate fields of study. He/she will be informed by the advisory committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.

Ottawa-Carleton Institute for Civil Engineering

Mackenzie Bldg. 277
788-5784

The Institute

Director of the Institute: N.J. Gardner

Associate Director of the Institute: S.J. Kennedy

Established in 1984, the institute combines the research strengths and resources of the Departments of Civil Engineering at Carleton University and the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a wide range of fields of civil engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the director of the institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Civil Engineering at Carleton University and (O) for the Department of Civil Engineering at the University of Ottawa.

Kazimierz Adamowski, *Hydrology, Stochastic and Statistical Analyses* (O)

John Adjeleian, *Structures, Building Design and Construction* (C)

C.M. Allen, *Structures, Building Design and Construction* (C)

G.E. Bauer, *Foundation Engineering, Soil Mechanics, In-Situ Testing* (C)

J.J. Beaudoin*, *Cement Chemistry, Strength of Composite Materials* (O)

J.P. Braaksma, *Transportation, Airport Planning, Traffic Engineering* (C)

M.S. Cheung*, *Finite Element Analysis, Bridge Engineering* (O)

L. Droste, *Environmental Engineering, Water and Wastewater Treatment* (O)

M.A. Erki, *Structural Mechanics, Numerical Methods*, (C)

E. Evgin, *Finite Elements, Soil Plasticity, Environmental Geomechanics* (O)

B.H. Fellenius, *Geotechnical Engineering, Deep Foundations* (O)

N.J. Gardner, *Structures, Reinforced Concrete, Earthquake Engineering* (O)

V.K. Garga, *Geotechnical Engineering, Dams, Harbours, Heavy Foundations* (O)

A.O.A. Halim, *Transportation, Pavement and Materials, Geometric Design* (C)

G.A. Hartley, *Structural Analysis, Finite Elements, Building Frame Analysis* (C)

N.M. Holtz, *Computer-aided Structural Engineering* (C)

J.L. Humar, *Structures, Earthquake Engineering, Computer-aided Design* (C)

W.F. Johnson*, *Urban Transportation Planning and Management* (C)

P.J. Kurfurst*, *Rock Mechanics, Geological Engineering* (O)

S.J. Kennedy, *Concrete Structures, Experimental Methods* (C)

K.J. Kennedy*, *Environmental Engineering, Waste Water Treatment* (O)

A.M. Khan, *Transportation, Systems Planning, Engineering and Management* (C)

D.T. Lau, *Structural Mechanics, Earthquake Engineering* (C)

K.T. Law*, *Geotechnical Engineering, Embankments, In-Situ Testing* (C)

RR. Mayes, *Engineering Management* (C)

M.G. McGarry*, *Water Supply and Sanitation, Waste Water Treatment* (O)

S.S.F. Ng, *Structures, Numerical Methods, Dynamic Behaviour* (O)

A.G. Razaqpur, *Structures, Concrete, Numerical Methods* (C)

M. Saatioglu, *Building Structures, Reinforced Concrete, Earthquake Analysis and Design* (O)

J.J. Salinas, *Building Structures, Wood Engineering* (C)

E.J. Schiller, *Environmental Engineering, Water Supply and Irrigation* (O)

G.Y. Sebastian, *Transportation, Engineering Management* (C)

A.P.S. Selvadurai, *Geotechnical Engineering, Continuum Mechanics, Applied Mathematics* (C)

K. Sepelhr, *Geotechnical Engineering, Continuum Mechanics, Finite Elements* (C)

N.K. Sinha*, *Ice Mechanics* (O)

G.T. Suter, *Structural Engineering, Masonry Structures* (C)

Hiroshi Tanaka, *Structures, Wind Engineering* (O)

R.D. Townsend, *Water Resource Engineering, Applied Hydraulics, River Engineering* (O)

R.L. Wardlaw*, *Wind Engineering, Aerodynamics* (O)

R.G. Warnock, *Water Resource Engineering, Stream Flow, Sedimentary Transport* (O)

P.E. Wisner, *Water Resource Engineering, Urban Hydrology, Environmental Impact Assessment* (O)

E.W. Wright*, *Structures, Computer-aided Design* (C)

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in civil engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. The requirements for the master's degree by thesis are:

- Equivalent of 18 course credits
- Thesis
- Participation in the Civil Engineering seminar series
- Successful oral defence of the thesis.

The requirements for the master's degree by course work are: 36 course credits, of which a minimum of 24 will be course credits and a minimum of 6 will be project credits.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in civil engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term.

- A minimum of 18 course credits
- Participation in the Civil Engineering seminar series
- Successful completion of written and oral comprehensive examinations in subject areas determined by the student's advisory committee
- Successful completion of a thesis proposal examination
- Thesis
- Successful oral defence of the thesis. The examination board for all theses will include an external examiner, and when possible, professors from both departments
- Subject to approval of his/her advisory committee, a Ph.D. student may take, or be required to take, courses in other disciplines.

Students who have been permitted to transfer into the Ph.D. program from a master's program without having completed the master's degree, will require 36 course credits for the Ph.D. degree which include transfer of credits from the incompleted master's program.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. The codes given in parenthesis are those used by the University of Ottawa. Courses beginning with "82" are offered at Carleton University and those beginning with "83" are offered at the University of Ottawa. Not all courses listed are necessarily given during one academic year.

Geotechnical and Soils

82.529 (CVG 7100)	Case Studies in Geotechnical Engineering
82.530 (CVG 7101)	Advanced Soil Mechanics I
82.531 (CVG 7102)	Advanced Soil Mechanics II
82.533 (CVG 7103)	Pavements and Materials
82.550 (CVG 7104)	Earth Retaining Structures
82.551 (CVG 7105)	Foundation Engineering
82.552 (CVG 7106)	In-Situ Methods in Geomechanics
82.553 (CVG 7107)	Numerical Methods in Geomechanics
82.554 (CVG 7108)	Seepage and Water Flow Through Soils
82.572 (CVG 7109)	Special Topics in Geotechnical Engineering: Analysis of Embankments and Slopes
83.500 (CVG 5100)	Deep Foundations
83.501 (CVG 5101)	Advanced Rock Mechanics
83.502 (CVG 5102)	Theoretical Soil Mechanics
83.503 (CVG 5103)	Dam Engineering
83.504 (CVG 5104)	Soil Testing and Properties
83.505 (CVG 5105)	Slope Stability
83.506 (CVG 5106)	Site Improvements
83.509 (CVG 5300)	Geotechnical Engineering in Cold Regions
83.510 (CVG 8303)	Soil Dynamics
83.511 (CVG 8101)	Advanced Topics: Geotechnical Engineering

Structures and Construction Management

82.511 (CVG 7120)	Introductory Elasticity
82.512 (CVG 7121)	Advanced Elasticity
82.513 (CVG 7122)	Finite Element Methods in Stress Analysis
82.514 (CVG 7123)	Earthquake Analysis and Design of Structures
82.515 (CVG 7124)	Advanced Finite Element Analysis in Structural Mechanics
82.523 (CVG 7125)	Theory of Structural Stability
82.524 (CVG 7126)	Behaviour of Steel Structures
82.525 (CVG 7127)	Analysis of Elastic Structures
82.526 (CVG 7128)	Prestressed Concrete
82.527 (CVG 7129)	Advanced Structural Design

- 82.528 (CVG 7130) Advanced Reinforced Concrete
- 82.560 (CVG 7131) Project Management
- 82.563 (CVG 7132) Computer-Aided Design of Building Structures
- 82.570 (CVG 7133) Special Topics. Topics covered include: Building Design and Construction; Engineered Masonry Behaviour and Design; Advanced Methods in Computer-Aided Design; Statistics, Probabilities and Decision Making; Applications in Civil Engineering
- 83.520 (CVG 5141) Plastic Design of Steel Structures
- 83.521 (CVG 5142) Advanced Structural Dynamics
- 83.522 (CVG 5143) Advanced Structural Steel Design
- 83.523 (CVG 5145) Theory of Elasticity
- 83.524 (CVG 5147) Theory of Plates and Shells
- 83.525 (CVG 5149) Stability of Structures
- 83.526 (CVG 5150) Advanced Concrete Technology
- 83.527 (CVG 5151) Flow Induced Vibration
- 83.528 (CVG 5152) Steel Bridges
- 83.529 (CVG 5153) Wind Engineering
- 83.530 (CVG 5340) Advanced Reinforced Concrete Design
- 83.531 (CVG 5341) Finite Element Methods I
- 83.532 (CVG 5342) Numerical Methods of Structural Analysis
- 83.533 (CVG 5343) Finite Element Methods II
- 83.534 (CVG 5347) Random Vibrations of Structures
- 83.535 (CVG 5348) Prestressed Concrete Design
- 83.536 (CVG 8102) Advanced Topics, Structural Engineering

Transportation

- 82.534 (CVG 7150) Intercity Transportation, Planning and Management
- 82.535 (CVG 7151) Traffic Engineering
- 82.536 (CVG 7152) Highway Materials
- 82.537 (CVG 7153) Urban Transportation and Management
- 82.538 (CVG 7154) Geometric Design
- 82.539 (CVG 7155) Intercity Transportation Supply
- 82.540 (CVG 7160) Case Studies in Traffic Engineering
- 82.541 (CVG 7156) Transportation Economics and Policy
- 82.542 (CVG 7159) Transportation Terminals
- 82.543 (CVG 7158) Airport Planning
- 82.574 (CVG 7157) Special Topics in Transportation Planning and Technology

Water Resources

- 83.550 (CVG 5110) Hydraulics of Open Channels
- 83.551 (CVG 5111) Hydraulic Structures
- 83.552 (CVG 5114) Hydraulics and Porous Media
- 83.553 (CVG 5115) Advanced Fluid Mechanics
- 83.555 (CVG 5117) Applied Hydrodynamics
- 83.556 (CVG 5120) Water Resources Systems
- 83.557 (CVG 5121) Physical Hydrology
- 83.558 (CVG 5122) Groundwater and Seepage
- 83.559 (CVG 5123) Advanced Topics in Hydrology
- 83.560 (CVG 5124) Dispersion Processes in Hydrologic Flows
- 83.561 (CVG 5125) Statistical Methods in Hydrology
- 83.562 (CVG 5126) Stochastic Hydrology
- 83.563 (CVG 5127) Hydrologic Systems Analysis
- 83.564 (CVG 5128) Water Resources Planning and Policy
- 83.565 (CVG 5129) Applied Hydrology
- 83.566 (CVG 5131) River Engineering
- 83.567 (CVG 5140) Irrigation and Drainage
- 83.568 (CVG 5154) Water Supply and Sanitation in Developing Countries
- 83.580 (CVG 5540) Irrigation et drainage
- 83.581 (CVG 5554) Approvisionnement en eau et assainissement dans les pays en voie de développement
- 83.582 (CVG 5119) Computational Hydraulics
- 83.583 (CVG 8103) Advanced Topics, Water Resources

Environmental

- 83.590 (CVG 5130) Wastewater Treatment Process Design
- 83.591 (CVG 5132) Unit Operations of Water Treatment
- 83.592 (CVG 5136) Design of Pollution Control Systems
- 83.593 (CVG 5139) Environmental Assessment of Civil Engineering Projects
- 83.594 (CVG 5330) Pollution Control Engineering
- 83.595 (CVG 5331) Experimental Methods in Pollution Control
- 83.596 (CVG 5332) Solid Waste Disposal
- 83.597 (CVG 5334) Chemical Analysis for Environmental Engineering
- 83.598 (CVG 5118) Theory and Operation of Hydraulic Models
- 83.599 (CVG 5539) Evaluation des effets de projets en génie civil sur l'environnement
- 83.601 (CVG 5119) Computational Hydraulics

Seminars and Directed Studies

- 82.596 (CVG 7180) Engineering Directed Studies
- 83.570 (CVG 5350) Special Directed Studies
- to to
- 83.579 (CVG 5375)

Projects and Theses

82.590 Engineering Project

82.599 M.Eng. Thesis

82.699 Ph.D. Thesis

CVG 6000 Civil Engineering Report/Rapport en
génie civilCVG 6001 Thesis Research in Civil Engineering I
(Fall trimester)Recherche en vue de la thèse de maîtrise en génie civil I
(trimestre d'automne)CVG 6002 Thesis Research in Civil Engineering II
(Winter trimester)Recherche en vue de la thèse de maîtrise en génie civil
II (trimestre d'hiver)CVG 6003 Thesis Research in Civil Engineering III
(Spring trimester)Recherche en vue de la thèse de maîtrise en génie civil
III (trimestre du printemps)

CVG 7999 M.A. Sc. Thesis/Thèse

CVG 9998 Comprehensive Examination (Ph.D.)

Examen général de doctorat

CVG 9999 Ph.D. Thesis/Thèse

Department of Civil Engineering

Mackenzie Bldg. 277
788-5784

The Department

Chair of the Department: A.P.S. Selvadurai
Departmental Supervisor of Graduate Studies:
S.J. Kennedy

The Department of Civil Engineering offers programs of study and research leading to the Master of Engineering and Ph.D. degrees in Civil Engineering. These degrees are offered through the Ottawa-Carleton Institute for Civil Engineering which is jointly administered by the Department of Civil Engineering at Carleton University, and the Department of Civil Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 12.

The department conducts research and has developed graduate programs in the following areas:

- **Structural Mechanics**

The graduate program in structural mechanics concentrates on analytical and design studies in the following fields: computer applications in structural analysis, behaviour of steel, concrete and composite structures; structural dynamics, seismic analysis; structural optimization; finite element analysis. Graduate research in structural mechanics is currently directed to the following areas:

Computer Applications in Structural Design

Computer-based systems for analysis, design, and graphics processing; structural analysis of building frames; pre- and post-processing of frame analysis and finite element analysis packages in structural applications

Seismic Analysis and Design

Seismic response of set-back and other irregular buildings; computer analyses of linear and non-linear structural response; design of buildings for seismic forces

Continuum Mechanics

Linear and nonlinear problems in elasticity; analysis of contact problems in elasticity, plasticity, and viscoelasticity; mechanics of composite materials; fracture processes in geological materials; finite deformations of rubberlike materials

- **Building Design and Construction**

The graduate program in building design and construction emphasizes the following fields: masonry behaviour and design, timber structures; structural systems and design optimization; integrated treatment of structural, mechanical, and electrical building requirements; construction economics, project planning. Graduate research in building design and construction is currently directed to the following areas:

Computer-Aided Building Design

Development of applications software for design of building structural components and systems

Numerical Modelling of Buildings and Bridges

Advanced analytical modelling of reinforced and prestressed concrete, steel, and composite concrete-steel buildings and bridges. Material and geometric nonlinearities, bond-slip, the advent and propagation of cracks, tension-stiffening and shear-connectors behaviour are modelled to predict the full response of structures up to failure.

Masonry Behaviour and Design

Shear strength of reinforced masonry beams; masonry deformations; floor systems for masonry structures; winter masonry construction

Timber Structures

Analysis, design and performance evaluation of wood-structured systems and components; structural reliability

- **Transportation Planning and Technology**

The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design, and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modelling and simulation, urban and regional studies, traffic engineering, and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design. Graduate research in transportation is currently focused on the following areas:

Transport Policy

Assessment and impact analysis of national, regional, and urban transportation policies

Planning and Design Methodology

Development and application of models for optimization of transport supply, transportation system management

Travel and Traffic Analyses

Behavioural theories of passenger travel, goods movement, empirical traffic studies

Transportation Terminals

Airport planning, air terminal design; bus, rail, subway terminal design, layout methods, pedestrian traffic

Transportation Technology Development and Assessment

Modernization of passenger and freight rail services; soil properties; pavement design, multi-layered systems, low temperature cracking of pavements, thermo-mechanical modelling of fracture processes in pavements, highway design, energy

• Geotechnical Engineering

The graduate program in geotechnical engineering places an emphasis on both theoretical and applied problems related to soil and rock mechanics and foundation engineering. These generally include the study of mechanical properties of soil and rock materials, stability of natural slopes and earth embankments, soil-foundation-structure interaction, and problems in foundation design and geomechanics. Broader programs in geotechnical engineering may be arranged by making use of courses offered in the Department of Geography at Carleton University and in the Department of Civil Engineering at the University of Ottawa. Graduate research in geotechnical engineering is primarily directed towards the following areas:

Soil-Foundation Interaction

Elastic and consolidation effects of soil-foundation interaction; soil-frame interaction; contact stress measurement; performance of rigid and flexible foundations; buried pipelines

Bearing Capacity and Settlement

Problems related to design of bridge abutments and footings located on sloped granular fill, experimental and field studies

In-Situ Testing of Soils

The use of devices such as the pressure meter, the screw plate test, the borehole shear device, and borehole dilatometer in the assessment of geotechnical properties of soils

Mechanical Behaviour

Development of constitutive relations for soils and rock masses with yield and creep characteristics; applications to foundation engineering

Mechanics of Geological Structures

Large strain phenomena; buckling of strata; applications to underground storage structures; hydraulic fracture of oil- and gas-bearing geological media

Performance of Anchors

Theoretical and experimental analysis of deep and shallow anchors in soil, rock, and concrete; group action; creep effects; prestress loss

Nuclear Waste Disposal

Theoretical modelling of rockmass-buffer-canister interaction during moisture migration; non-homogeneous swelling of buffer materials; swelling pressures in buffer systems

Laboratory facilities include a 400,000 lb. universal testing machine with auxiliary equipment for load and strain control; an electrotesting machine, specialized equipment for torsion and impact studies; advanced equipment for electric resistance strain gauge work; and a wide selection of other loading, measuring, and recording equipment for testing structural materials and components. The concrete laboratory has facilities

for the casting, curing, and testing of reinforced concrete members. Laboratory facilities in geotechnical engineering include both large scale and conventional tri-axial testing, consolidation testing, pore water pressure measurements, and model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures.

Computer-related equipment within the department comprises an HP 9000, an Apollo minicomputer, several microcomputers; five terminals, including two storage scope display terminals; and a digitizing table. This equipment is interfaced to the Honeywell Level 66 computer in the University computer centre. A library of computer programs for structural engineering is a significant resource for advanced study and research.

Graduate Courses*

• Engineering 82.511F1

Introductory Elasticity

Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constants; strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear co-ordinates; Airy-Mitchell stress functions and Fourier solutions, application of classical solutions to problems of engineering interest.

• Engineering 82.512W1

Advanced Elasticity

Continuation of topics introduced in Engineering 82.511. Complex variable solutions. Torsional and thermal stresses; axially symmetric three-dimensional problems, Love's strain potential, Boussinesq-Galerkin stress functions; problems related to infinite and semi-infinite domains. Introduction to numerical methods of stress analysis, comparison of solutions.

Prerequisite: Engineering 82.511 or permission of the department.

• Engineering 82.513W1

Finite Element Methods in Stress Analysis

Finite element theory and numerical methods. Constant strain triangles. Linear strain triangles. Reinforced triangles. Axi-symmetric shells. Axi-symmetric solids. Plates in bending. Throughout the course, application to engineering problems is emphasized.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• **Engineering 82.514W1**

Earthquake Analysis and Design of Structures

Structural dynamics, single- and multi-degree-of-freedom systems, formulation of equations of motion, free and forced vibrations, normal mode analysis. Seismological background, selection of design earthquake. Deterministic analysis of earthquake response, linear and nonlinear analysis, influence of foundation medium. Design considerations and code requirements, equivalent static load method, response spectrum approach.

• **Engineering 82.515S1**

Advanced Finite Element Analysis in Structural Mechanics Fundamentals of calculus of variations; variational and Galerkin formulations: assumed displacement, assumed stress and hybrid elements; isoparametric elements and numerical integration; plate bending: convergence, completeness and conformity, patch test, Kirchhoff and Mindlin plate theories, nonlinear elasticity and plasticity; cracking and nonlinearities in reinforced concrete structures; incremental and iterative schemes, geometric nonlinearity: small strain — large displacement, large strain — large displacement, Eulerian and Lagrangian formulations; finite elements in dynamics; finite element programming.

Prerequisite: Engineering 82.513 or permission of the department.

• **Engineering 82.523W1**

Theory of Structural Stability

Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams.

Prerequisite: Engineering 82.525 or equivalent.

• **Engineering 82.524F1**

Behaviour of Steel Structures

Steel as a structural material; bolted and welded connections; brittle fracture and fatigue; members subjected to combined bending and compression, and to twist and local buckling; structural stability of frames.

Engineering 82.525F1

Analysis of Elastic Structures

Application of matrices to structural analysis; force and displacement method of analysis for framed elastic planar and space structures; introduction to structural dynamics.

• **Engineering 82.526W1**

Prestressed Concrete

Prestressed concrete materials; working stress design for flexure; ultimate strength design for flexure, shear, and torsion; prestress losses; deflection and camber; slabs; indeterminate beams and frames; introduction to prestressed bridges and circular tanks.

• **Engineering 82.527W1**

Advanced Structural Design

A number of topics, such as the evolution of a struc-

ture, structural form, aesthetics, progressive collapse, and design in various structural materials, are treated by members of the department and outside experts.

• **Engineering 82.528F1**

Advanced Reinforced Concrete

The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; safety and limit states design; computer design of concrete structures.

• **Engineering 82.529S1**

Case Studies in Geotechnical Engineering

The critical study of case histories relating to current procedures of design and construction in geotechnical engineering. The importance of instrumentation and monitoring field behaviour will be stressed. In-situ testing.

• **Engineering 82.530F1**

Advanced Soil Mechanics I

Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils.

• **Engineering 82.531W1**

Advanced Soil Mechanics II

Plasticity in soil mechanics; failure and yield criteria, plastic equilibrium, upper and lower bound solutions, uniqueness theorems; statically and kinematically admissible states; stability analysis of cohesive and cohesionless soils.

• **Engineering 82.533F1**

Pavements and Materials

An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements.

• **Engineering 82.534F1**

Intercity Transportation, Planning and Management

Current modal and intermodal issues, including energy. Framework and process of intercity transport planning and management. Recent trends and system development. Passenger and freight demand and service characteristics. Future prospects and possibilities.

• **Engineering 82.535F1**

Traffic Engineering

Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed, and delay studies. Traffic stream characteristics and queueing theory. Capacity analysis of roads and intersections. Safety.

• **Engineering 82.536W1**

Highway Materials

Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.

• Engineering 82.552W1

In-Situ Methods in Geomechanics

Scope of a subsurface exploration program. Techniques of soil and rock sampling. Geophysical methods. Mechanical and hydraulic properties of soil and rock. In-situ determination of strength, deformability and permeability of soils and rocks. Critical evaluation of vane, pressuremeter, screw plate, flat dilatometer, borehole shear and plate load tests. Pumping, recharge and packer tests. Permeability of jointed rocks. Rock testing techniques, borehole dilatometer, flat jack, cable jacking tests. Properties of rock joints. In-situ stress measurements.

• Engineering 82.553S1

Numerical Methods in Geomechanics

Critical review of advanced theories of soil and rock behaviour. Linear elasticity, non-homogeneity and anisotropy. Plasticity models. Generalized Mohr-Coulomb and Drucker-Prager failure criteria. Critical state and cap models. Dilatancy effects. Associated and non-associated flow rules. Hardening rules, hypoelasticity. Soil consolidation, viscoelasticity and creep behaviour of rock masses. Rock joints. Finite element formulation of nonlinear problems. Iterative schemes; tangent stiffness, initial stress and initial strain techniques, mixed methods. Time marching schemes. Solution of typical boundary value problems in geomechanics with the aid of existing research class finite element codes.

Prerequisites: Engineering 82.511, 82.513, or permission of the department.

• Engineering 82.554S1

Seepage and Waterflow through Soils

Surface-subsurface water relations. Steady flow. Flownet techniques. Numerical techniques. Seepage analogy models. Anisotropic and layered soils. Water retaining structures. Safety against erosion and piping. Filter design. Steady and non-steady flow towards wells. Multiple well systems. Subsidence due to ground water pumping.

• Engineering 82.560S1

Project Management

Introduction to managing the development, design, and construction of buildings. Examination of project management for the total development process, including interrelationships among owners, developers, financing sources, designers, contractors, and users; role and tasks of the project manager; setting of project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints, control of cost, time, and content quality and process; human factors.

• Engineering 82.563S1

Computer-Aided Design of Building Structures

Relevant aspects of computer systems, information handling, auxiliary storage; design methods, computer-

• Engineering 82.537W1

Urban Transportation Planning and Management

Urban transportation systems planning and management. Urban development models — an introduction. Urban transportation policy.

• Engineering 82.538W1

Geometric Design

Basic highway geometric design concepts. Vertical and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility; operational uniformity, and route continuity on freeways.

• Engineering 82.539W1

Transportation Supply

Advanced treatment of transportation planning and management concepts and techniques: transport supply issues, capacity and costs, evaluation of system improvements and extensions, transportation and development, policy impact analysis.

• Engineering 82.541W1

Transportation Economics and Policy

Transportation, economic analysis framework. Transport industry output. Carrier operations. Issues of resource utilization, measurement, economics of supply of infrastructure, pricing; subsidies, externalities. Transport policy in Canada.

• Engineering 82.542F1

Transportation Terminals

Framework for passenger terminal planning and design. Theory: the transfer function and network modelling; pedestrian flow characteristics; capacity of corridors, stairs, escalators, and elevators; layout planning. Practical applications: air, rail, metro, bus, ferry, and multi-modal terminals.

• Engineering 82.543F1

Airport Planning

Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise, airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning.

• Engineering 82.550F1

Earth Retaining Structures

Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies.

• Engineering 82.551W1

Foundation Engineering

Review of methods of estimating compression and shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ testing for design purposes. Instrumentation and performance of prototype structures. Design codes.

ized design systems; computer graphics; application of structural theory; examination of a selected series of structural engineering programs and programming systems.

- Engineering 82.570F1, W1, S1

Special Topics in Building Design and Construction Courses in special topics related to building design and construction, not covered by other graduate courses; details will be available some months prior to registration.

- Engineered Masonry Behaviour and Design

Properties of masonry materials and assemblages. Behaviour and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of lowrise and highrise structures. Discussion of masonry problems. Emphasis throughout the course is given to a practice-oriented approach.

- Statistics, Probabilities and Decision-Making Applications in Civil Engineering

Review of basic concepts in statistics and the Theory of Probabilities. Bayes' Theorem. Probability distributions. Moments. Parameter Estimation. Goodness of fit. Regression and correlation. OC curves. Monte Carlo simulation. Probability-based design criteria. Systems reliability. Limit States Design. Selected applications in transportation, geomechanics and structures. Emphasis will be given to problem solving. Use of existing computer software.

- Design of Steel Bridges

Basic features of steel bridges, design of slab-on-girder, box girder and truss bridges. Composite and non-composite design. Introduction to long span suspension and cable-stayed bridges. Discussion of relevant codes and specifications.

- Design of Concrete Bridges

Concrete and reinforcing steel properties, basic features of concrete bridges, design of superstructure in reinforced concrete slab, slab-on-girder and box girder bridges, an introduction to prestressed concrete bridges, design of bridge piers and abutments. In all cases the relevant provisions of Canadian bridge codes are discussed.

- Engineering 82.572F1, W1, S1

Special Topics in Geotechnical Engineering Courses in special topics in geotechnical engineering, not covered by other graduate courses; details will be available some months prior to registration.

- Analysis of Embankments and Slopes

Stability of embankments of soft clays; stress-strain analysis; anisotropy; strain rate effect; short and long-term settlement; methods of slope stability analysis; progressive failure; use of stability charts; slope analysis for residual and unsaturated soils.

- Engineering 82.574F1, W1, S1

Special Topics in Transportation Planning and Technology

Courses in special topics in transportation engineering, not covered by other graduate courses; details will be available some months prior to registration.

- Engineering Management

Engineering management principles, including program and project organization, personnel management, major management systems, project management, legal aspects of management, communication problems, politics and management, management of the engineering competition and union-management problems.

- Engineering 82.590F2, W2, S2

Civil Engineering Project

Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis, or design project under the general supervision of a member of the department.

- Engineering 82.596F1, W1, S1

Directed Studies

- Engineering 82.599F4, W4, S4

M.Eng. Thesis

- Engineering 82.699F, W, S

Ph.D. Thesis

Other Courses of Particular Interest

Mechanical and Aeronautical Engineering

- 88.514 Ground Transportation Systems and Vehicles
- 88.517 Experimental Stress Analysis
- 88.521 Methods of Energy Conversion
- 88.550 Advanced Vibration Analysis
- 88.561 Creative Problem Solving and Design
- 88.562 Failure Prevention
- 88.568 Advanced Engineering Materials

Systems and Computer Engineering

- 94.501 Simulation and Modelling

Geography

- 45.415E Slope Development: Forms, Processes and Stability
- 45.417 Glacial Geomorphology
- 45.532 Soil Thermal and Hydrologic Properties
- 45.533 Periglacial Geomorphology
- 45.534 Aspects of Clay Mineralogy and Soil Chemistry
- 45.579 Research and Development in Outdoor Recreational Geography

Public Administration

- 50.510 Management Accounting
- 50.511 Financial Management

Ottawa-Carleton Institute for Electrical Engineering

Mackenzie Bldg. 352
788-5659

The Institute

Director of the Institute: B.A. Syrett

Established in 1983, the institute combines the research strengths and resources of the Departments of Electronics and of Systems and Computer Engineering at Carleton University and the Department of Electrical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a wide range of fields of electrical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission should be sent to the director of the institute.

Members of the Institute

The "home" department of each member is indicated by (OE) for the Department of Electrical Engineering, University of Ottawa; (CE) for the Department of Electronics, Carleton University; (SCE) for the Department of Systems and Computer Engineering, Carleton University.

T. Aboulnasr, *Digital Signal Processing* (OE)

N.U. Ahmed, *Systems Theory, Optimal Control, Filtering and Reliability* (OE)

Sami Aly, *Signal Processing, Digital Transmission* (SCE)

Prakash Bhartia, *Microwaves, Antennas, Instrumentation* (OE)

A.R. Boothroyd, *Solid State Devices, ICs, CAD* (CE)

B.A. Bowen, *Expert Systems, Systems Design* (SCE)

R.J.A. Buhr, *Software Engineering, Protocols, CAD of Computer Systems* (SCE)

C.H. Chan, *VLSI Circuits, Systems* (CE)

J.W. Chinneck, *Computer Modelling, Operations Research* (SCE)

J.Y. Chouinard, *Mobile Communications, Digital Channel Modelling, Information Theory*, (OE)

J. Chrostowski, *Photonics, Sensors* (OE)

Sorin Cohn-Sfetcu, *Telecommunications* (OE)

D.C. Coll, *Telecommunications and Computers* (SCE)

M.A. Copeland, *ICs, Analog Signal Processing, CAD* (CE)

George Costache, *Electromagnetic Engineering* (OE)

S.R. Das, *Digital Circuits, Computer Architecture, Faults in LSI/VLSI Systems* (OE)

N.W. Dawes, *Artificial Intelligence, Expert Systems* (SCE)

M. El-Tanany, *Mobile Communications, Spread Spectrum Systems, Wave Propagation* (SCE)

D.D. Falconer, *Digital Communications, Signal Processing, Digital Subscriber Loops* (SCE)

K. Feher, *Digital Communications, Transmission, Modulations* (OE)

Peter Galko, *Communications* (OE)

N.D. Georganas, *Computer-Communications, Mobile Radio* (OE)

D.T. Gibbons, *Digital and Biomedical Electronics, Microprocessors* (OE)

Morris Goldberg, *Image Processing, Pattern Recognition* (OE)

David Goodenough, *Remote Sensing, Artificial Intelligence, Image Analysis* (OE)

R.A. Goubran, *Digital Systems Design, Mobile Communications* (SCE)

H.M. Hafez, *Digital Modulation Techniques, Packet Radio Switching, Cellular Digital Radio* (SCE)

R.G. Harrison, *Microwaves, Non-linear Processes* (CE)

W.J.R. Hoefler, *CAD/CAM of Microwave Circuits, Numerical Methods* (OE)

M.J. Hunt, *Speech Technology, Solid State NMR, Pattern Recognition* (OE)

Daniel Ionescu, *Digital Computers, Computer Process Control* (OE)

A. Javed, *Communications* (OE)

G.M. Karam, *Software Engineering, Concurrent Systems, Logic Programming* (SCE)

A.R. Kaye, *Office Technology, Embedded Knowledge Systems, Computer Networks* (SCE)

J.P. Knight, *Logic Design, Computer-Aided IC Design* (CE)

Mahshad Koohgoli, *Digital Signal Processing, Mobile Communications* (SCE)

Moshe Krieger, *Computer Architecture, Microprocessor, CAM* (OE)

T.A. Kwasniewski, *Digital and Analog Signal Processing, Microprocessors* (CE)

J.-Y. Le Boudec, *Communications Systems* (SCE)

H.W. Lee, *Communication Systems, Computer Networks* (SCE)

S.A. Mahmoud, *Distributed Databases, Radio Packet Switching, Communication Network Protocol* (SCE)

Vassilios Makios, *Microwaves, Fiber Optics* (CE)

William McGee, *Communications, Circuits* (OE)

L.R. Morris, *Signal Processing, Minicomputers, Computer Graphics, Software* (SCE)

M.S. Nakhla, *CAD for VLSI* (CE)

Michel Ney, *Electromagnetic Engineering* (OE)
Morteza Niktash, *Computer Communications Protocols, Databases, Real-Time Software Systems, Compilers* (SCE)
Bernard Pagurek, *Queueing, Databases* (SCE)
R.D. Peacock, *Artificial Intelligence* (SCE)
Emil Petriu, *Computer Engineering, Robotics* (OE)
J.S. Riordon, *Distributed Databases, Radio Packet Switching, Systems Modelling* (SCE)
H.M. Schwartz, *Automation, Robotics, Controls* (SCE)
A.U.H. Sheikh, *Mobile and Data Communications, Noise* (SCE)
W.J.D. Steenaart, *Digital Communications, Signal Processing* (OE)
M.A. Stuchly, *Biological Effects of Microwaves* (OE)
S.S. Stuchly, *Microwaves, Antennas, Instrumentation* (OE)
B.A. Syrett, *Microwaves, Fiber Optical Communications* (CE)
N.G. Tarr, *Solid State Devices, Fabrication* (CE)
R.E. Thomas, *Solid State Technology, Solar Energy* (CE)
P.D. van der Puije, *Circuit Synthesis, Biomedical Engineering* (CE)
D.J. Walkey, *CAD for VLSI, IC Design* (CE)
J.S. Wight, *Phase-locked Circuits, Microwaves, Antennas, Radar, Spread Spectrum* (CE)
C.M. Woodside, *Computer Performance, Queueing, Distributed System Design* (SCE)
O. Yang, *Computer Communications* (OE)
A. Yongaçoglu, *Digital Communications Coding and Modulation* (OE)

Master's Degree

Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high honours standing in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the departmental chairman, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

At the University of Ottawa, master's programs with a thesis earn the Master of Applied Science degree, while other master's programs earn the Master of Engineering degree. At Carleton University, all master's programs earn the Master of Engineering degree.

Master's Degree by Thesis

- 18 course credits plus a thesis

Master's Degree by Course Work

- 27 course credits plus a project (nominally 6 credits)

Co-operative Master's Degree by Thesis

- 18 course credits plus a thesis

Co-operative Master's Degree by Course Work

- 24 course credits plus 2 projects (each conducted in one work term).

Participation in the co-operative master's program is subject to acceptance by a suitable sponsoring organization

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the advisory committee, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

- A minimum of 14 course credits
- A comprehensive examination involving written and oral examinations and a written thesis proposal, to take place before the end of the fourth term of registration.
- A thesis which must be defended at an oral examination.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or advisory committee. Course descriptions may be found in the departmental section of the calendar. All courses are of one term duration. Only a selection of courses listed is given in a particular academic year. The following codes identify the department offering the course.

Carleton University

- 94. Department of Systems and Computer Engineering
- 97. Department of Electronics

University of Ottawa

- 92. Department of Electrical Engineering

The CSI designation refers to the Department of Computer Science at the University of Ottawa. The ELG designation refers to the Department of Electrical Engineering at the University of Ottawa.

Department of Electronics

Mackenzie Bldg. 417

788-5754

The Department

Chair of the Department: J.S. Wight

Departmental Supervisor of Graduate Studies:

C.H. Chan

Programs of study and research leading to the master's and Ph.D. degrees in electrical engineering are offered through the Ottawa-Carleton Institute for Electrical Engineering. The institute, established in 1983, combines the resources of Carleton University and the University of Ottawa. For further information, including admission and program requirements, see page 00.

The Department of Electronics is concerned with the fields of applied and physical electronics. Effort is strongest in two broad areas. One of these encompasses solid-state devices and integrated circuits, the other communications and microwaves. Specific areas of specialization include:

Solid State Devices

Semiconductor device development; device modeling; device innovation; new device processes; small geometry devices; photovoltaics, solar cells and materials for solar cells

Integrated Circuit Engineering

Design and development of linear and digital integrated circuits, fabrication processes and test techniques; MOS and bipolar ICs; VLSI, computer-aided circuit design; laser processing

Analog Signal Processing

Switched-capacitor filters, transversal filters and operational amplifiers in analog signal processing applications, particularly for integrated circuit realization

Circuits

Active filters; linear and nonlinear circuit design; computer-aided circuit design; phase-locked circuits, carrier and clock synchronizers

Microwave Electronics

Microwave amplifiers, oscillators, modulators, frequency converters, phase-shifters; use of FET and bipolar transistors, Schottky barrier, varactor, step recovery and PIN diodes; design using finline, microstrip, stripline, coax, and waveguide; Monolithic microwave ICs in GaAs.

Communications and Radar Electronics

Circuits for terrestrial and satellite communications; circuit implementation of digital modulation techniques; antenna and array design; communication channel characterization; optical communications circuits; radar transmitter and receiver design

Biomedical Electronics

Cochlear prosthesis

Computer-Aided Circuit Design

Development of hierarchical simulators for mixed analog/digital circuits; analysis and design of switched-capacitor networks; analysis and design of high speed circuits; optimization techniques; synthesis of VLSI circuits using both algorithmic and knowledge-based approaches; analysis and simulations of communications systems links.

NSERC/BNR Chair in CAD

The joint Natural Sciences and Engineering Research Council/Bell Northern Research Chair in Computer-Aided Design is currently held by Dr. Michel Nakhla. This is part of a planned expansion of the Department in the area of CAD for VLSI.

Ottawa-Carleton Centre for Communications Research

The newly-formed Ottawa-Carleton Centre for Communications Research (OCCCR) is a multidisciplinary interdepartmental research group comprising faculty members, full-time research staff, postdoctoral fellows, visiting researchers, graduate students, and support staff from both Carleton University and the University of Ottawa. It is part of the newly-formed Centre of Excellence "TRIO" (Telecommunications Research Institute of Ontario). Current research areas of the Centre with major participation from our Department are: integrated services digital networks, mobile and portable wireless networks, and VLSI in communications.

The structure of courses offered allows a well-integrated master's or Ph.D. program of study to be chosen appropriately related to the field of thesis research. Device- and integrated-circuit-oriented courses cover: fabrication, semiconductor device theory, semiconductor device design, integrated circuit design and integrated circuit reliability. Circuit-oriented courses include: signal-processing electronics, microprocessor electronics, computer-aided circuit design, phase-locked circuits, filter circuits, RF and microwave circuits, antenna and array design. Systems-oriented courses cover: optical fiber communications and radar systems.

Excellent facilities are available for the fabrication of solid state devices and integrated circuits for research purposes. These include a laboratory in which processes required in silicon monolithic technology can be carried out. Among equipment items are modern diffusion furnaces, facilities for thin-film deposition

including a low-pressure chemical vapour deposition system, an epitaxial reactor, a high-power cw Argon laser for laser annealing, facilities for photolithography and mask-making, plasma etching, thick film deposition, scribing, bonding, and automatic testing. The department has excellent computing facilities available for both circuit design and software development, including facilities for IC design and layout on the silicon chip, allowing IC fabrication either through the Canadian Microelectronics Corporation or in-house. The CAD laboratory, consisting of twenty-two PC-based microcomputers is available for integrated circuit design, analysis and layout, together with a Metheus workstation, five SUN3 computers and a VLSI test station. The department has access to a VAX 11/750 for CAD software development with COMMON LISP as the primary tool. Also available is an Apollo workstation connected to an interdepartmental network which includes an FPS 164 attached processor. University facilities include interactive time-sharing and batch processing using a Honeywell Level 66 mainframe.

The Department's integrated circuits testing instrumentation supports automated testing for both analog and digital circuit implementations. Low noise test beds and instruments such as spectrum analyzers, locking amplifier, signal generators, digital data generators and analyzer are linked together with controlling computers facilitating characterization and testing of high performance analog and digital circuits.

The department has up-to-date facilities for circuit development and measurement at frequencies ranging from dc to 22 GHz. Also there are facilities for work at optical frequencies. Thin-film microwave integrated circuits can be fabricated in-house; there is provision for the fabrication of GaAs MMIC's through foundry services. Special purpose microwave equipment includes automated network analyzers, spectrum analyzers and frequency synthesizers, and a complete microwave link analyzer. Data generators and error-detection equipment is available for work on digital communications. Software, such as SUPERCOMPACT and TOUCHSTONE, is available for the computer-aided design and layout of microwave integrated circuits.

The research laboratories maintain extensive collaboration with government and industrial research and development agencies in the Ottawa area.

Graduate Courses*

The courses offered by the Department of Electronics are as follows:

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Engineering 97.551F1 (ELG6351)

Passive Microwave Circuits

Review of EM theory for guided waves; transmission lines and waveguides. Propagation in ferrites. Characteristics of planar transmission lines, both single and coupled: stripline, microstrip, coplanar lines, slotline. Representation of discontinuities in transmission lines and waveguides. Scattering-matrix characterization of microwave junctions and discontinuities. Microwave network analysis. Design theory (including CAD), characteristics, and use of microwave components such as impedance transformers, filters, hybrids, directional couplers, isolators and circulators with particular emphasis on their realization in microwave integrated circuits.

B.A. Syrett.

• Engineering 97.555F1 (ELG6355)

Passive Circuit Theory

General description of networks, leading to matrix representation of n-terminal lumped and distributed networks. Elements of matrix algebra as applied to networks. Properties of network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless two-ports, single and double-terminated. Modern filter theory; approximation of characteristics by rational functions; Butterworth and Chebyshev approximations. General parameter filters; graphical design. Elliptic filters, predistortion. Phase response and group delay; all-pass and Bessel filters.

P.D. van der Puije.

• Engineering 97.557W1 (ELG6357)

Active Circuit Theory

Characterization of negative resistance one-port networks, signal generation and amplification. Active two-ports; y, z, h, k, chain and scattering parameters. Measurement of two-port parameters. Activity and passivity; reciprocity, non-reciprocity, and anti-reciprocity. Gyrator as a circuit element. Stability, inherent and conditional; power gain of conjugate and mismatched two-port amplifiers. Amplifier gain sensitivity. Oscillators, maximal loading, and frequency sensitivity. Active filter design; gyrator, negative immittance converter (NIC) and operational amplifier used as functional elements. Practical realization of gyrators and NICs. Active network synthesis.

Prerequisite: Engineering 97.555 or equivalent.

P.D. van der Puije.

• Engineering 97.559F1 (ELG6359)

Integrated Circuit Technology

Survey of technology used in integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, chemical vapour deposition, etching, materials for metallization and contacting, and photolithography. Emphasis will be on technologies suitable for silicon LSI and VLSI, but GaAs processing will also be considered.

N.G. Tarr.

• Engineering 97.562W1 (ELG6362)

Microwave Semiconductor Devices and Applications
Review of basic semiconductor physics, PN junctions and Schottky barriers. Discussion of basic principles of operation, characteristics and applications of varactor diodes (tuning, parametric amplifiers, frequency multipliers), p-i-n diodes (switches, limiters, attenuators, phase shifters), IMPATT and Gunn diodes (negative resistance amplifiers and oscillators), microwave bipolar transistors and MESFET's (amplifiers and oscillators). Design theory (including CAD) of amplifier matching networks. Discussion of microwave device/circuit fabrication technology (discrete, hybrid, monolithic).
B.A. Syrett.

• Engineering 97.564 (ELG6364)

Radar Systems

Fundamentals: range equation, minimum detectable signal, radar cross-section, pulse repetition frequency, range ambiguities. **Classes of Radar:** CW, FM-CW, MTI, tracking, air surveillance, SSR, PAR, MLS, SAR, SLAR, OTH, 3D and bistatic radars. **Radar subsystems:** transmitters, antennas, receivers, processors, displays. **Detection criteria:** CFAR receivers, noise, clutter, precipitation. **Waveform design:** ambiguity functions, pulse compression. **Propagation characteristics:** earth's curvature, refraction, diffraction, attenuation.
J.S. Wight.

• Engineering 97.565W1 (ELG6365)

Optical Fiber Communications

Transmission characteristics of and design considerations for multi-mode and single-mode optical fiber waveguides; materials, structures, and device properties of light-emitting diodes and laser light sources; photo-diodes, avalanche detectors; repeater design; coupling devices for fibers; noise generation and measurements; inter-modulation, cross-modulation, and non-linearity characterization; analog systems, digital systems, system design accounting for component signal degradation; data bus systems.

Mitch Gallant, David Kahn, Ranjit Mand and Paul Vella.

• Engineering 97.566W1 (ELG6366)

Phase-Locked Loops and Receiver Synchronizers

Phase-locked loops: components, fundamentals, stability, transient response, sinusoidal operation, noise performance, tracking, acquisition and optimization. **Receiver synchronizers:** carrier synchronizers including squaring loop, Costas loop, and remodulator for BPSK, QPSK BER performance; clock synchronizers including early late gate, inphase/midphase, and delay line multiplier; direct sequence spread spectrum code synchronizers including single dwell and multiple dwell serial PN acquisition, matched filter PN acquisition, delay locked loop and Tau-Dither loop PN tracking; frequency hopped spread spectrum time and frequency synchronization.
J.S. Wight.

• Engineering 97.567F1 (ELG6367)

Antennas and Arrays

Design parameters: pattern, radiation intensity, directivity, EIRP, radiation impedance, effective area, antenna noise. **Aperture fundamentals:** near field, pattern synthesis, beam steering and focusing, beam dimensions and scan angle, side-lobe levels and aperture taper. **Aperture antennas:** pyramidal and corrugated horns; plane, parabolic and offset parabolic reflectors; shaped beam and multiple spot beam synthesis; slot, slotted waveguide and microstrip antennas. **Phased array fundamentals:** grating lobes, Z-transform, beam steering, periodic, Chebyshev, aperiodic arrays. **Wire antennas:** infinitesimal elements, dipoles, Yagi, rhombic, log periodic, loop, helix antennas, baluns.
Peter Wood.

• Engineering 97.569W1 (ELG6369)

Nonlinear Microwave Devices and Effects

Construction of nonlinear microwave devices, their application in practical networks, and the mathematical treatment of their consequent behaviour. **Nonlinear-resistance devices:** power detectors, mixers, and frequency multipliers. **Nonlinear-reactance devices:** varactors, parametric circuits for frequency-multiplication, mixing and frequency-division, voltage-controlled oscillators. **Exploitation of nonlinear phenomena in single- and dual-gate GaAs FETs and other active devices leading to multipliers, dividers and mixers with gain.** **Realization of these circuits in waveguide, finline and monolithic microwave IC form.**
R.G. Harrison.

• Engineering 97.570 (ELG6370)

Spread Spectrum Systems

Fundamentals: jamming, energy allocations, system configurations, energy gain, applications such as anti-jam, low probability of intercept, multiple access, time of arrival. **Anti-jam systems:** parameters, jammer waveforms, uncoded and coded direct sequence BPSK, uncoded and coded binary FSK, interleaver/hop tradeoff, coded BER bounds, cutoff rates, DS-BPSK and pulse jamming bounds, FH-MFSK and partial band jamming bounds, diversity for FH-MFSK, concatenation of codes. **Pseudo-noise generators:** storage/generation, linear recursions, memory efficient linear generators, statistical properties of M sequences, Galois field connections, nonlinear feed forward logic, DS and FH multiple access design. **Code synchronizers:** single dwell and multiple dwell serial PN acquisition for DS, delay locked loop and Tau-Dither loop PN tracking for DS, time and frequency synchronization for FH.
J.S. Wight.

• Engineering 95.571F1 (ELG 6371)

Optical and Microwave Remote Sensing Instrumentation

Introduction to airborne and remote sensing for environmental monitoring. Interaction of optical and microwave radiation with the earth's surface and its

impact on sensing and instrumentation design and operation. Airborne platform motion compensation schemes and their application to geometric correction of airborne imagery. Passive and active electro-optical sensors. Radar systems: clutter measurement; scatterometers, real aperture strip mapping radar (SLAR); synthetic aperture strip mapping radars (SAR). C.E. Livingstone et al.

• Engineering 97.579F1, W1 (ELG 6379)

Advanced Topics in Electromagnetics

Recent and advanced topics in electromagnetics, antennas, radar systems, microwave devices and circuits, or optoelectronics. The subject material will vary from year to year according to research interests in the department and/or expertise provided by visiting scholars or sessional lecturers.

• Engineering 97.580F1 (ELG6380)

Theory of Semiconductor Devices

Review of solid state physics underlying device mechanisms. Equilibrium and non-equilibrium conditions in a semiconductor. Carrier transport theory. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors, field effect devices. Current transport relationships for transistors. Charge control theory. Modelling of device mechanisms. Performance limitations of transistors.

A.R. Boothroyd.

• Engineering 97.581F1 (ELG6381)

Electronic Circuit Reliability

Basic considerations in electronic circuit reliability, with particular reference to integrated circuits. A brief introduction to reliability statistics. Probability density functions (for example, Gaussian, Log normal, Weibull, etc.). Reaction kinetics (Arrhenius relationship). Accelerated life testing: design of tests and analysis of results. Significance of differences (Chi-square test). Determination of confidence limits. Sampling plans: producer's and consumer's risk. Screening and Burn-in: MIL-M-38510 and MIL-STD-883. System reliability: FMECA, reliability-modelling, MIL-HDBK-217. Reliability physics. Failure modes and mechanisms of IC's, package and chip. Failure analysis tools and techniques, optical, infra-red, SEM, stroboscopic voltage contrast, X-ray microprobe, Auger analysis, ion microprobe. Reliability in IC design. Reliable design rules. Process control and qualification. Step-stress testing. Semiconductor test structures. VLSI reliability considerations.

D.V. Sulway.

• Engineering 97.582W1 (ELG6382)

Surface-Controlled Semiconductor Devices

Basic theory of the MOS capacitor structure; charge and capacitance relationships; characterization of practical structures. MOSFET theory: classical 1-D analysis, Pao-Sah model, charge-sheet model, saturation region analysis. Small-geometry devices, scaling

theory. Dynamic behaviour of MOSFETs: quasi-static models, capacitance characterization. Metal-semiconductor devices; Schottky diode structures and MESFETs. Device modelling for CAD.

Prerequisite: Engineering 97.580 or equivalent.

A.R. Boothroyd.

• Engineering 97.583 (ELG6383)

Silicon Compilers: Automated IC Synthesis

A number of topics related to computer analysis and synthesis of integrated circuits will be discussed. These topics will include automatic PLA/FSM (programmable logic array)/(finite state machine) compilers, silicon compilers and automatic test plan generators (ATPG).

Prerequisites: Some IC design experience as given, for example, by Engineering 97.584, and permission of the department.

J.P. Knight.

• Engineering 97.584F1 (ELG6384)

Integrated Circuit Engineering I

An integrated circuit design course with a strong emphasis on design methodology, to be followed by 97.585 in the second term. The design philosophies considered will be uncommitted gate-array, Mead-Conway and standard gate-level CMOS design. Computer-aided design tools are available including IC layout, logic and electrical simulation (SPICE).

C.H. Chan.

• Engineering 97.585W1 (ELG6385)

Integrated Circuit Engineering II

A continuation of 97.584. Students will have reviewed and tested earlier designs in the course, and will initiate their own design of an integrated circuit and submit it for fabrication where the design warrants. This course will require considerable project time in our CAD lab.

C.H. Chan and D.J. Walkey.

• Engineering 97.586F1 (ELG6386)

Computer-Aided Design: Circuit Design Aids

This course will cover design tools for analyzing and creating circuit designs. The topics covered will include: analog circuit simulation, digital circuit simulation, fault simulation, physical and electrical design rule checking, logic simplification and transformation, and automatic layout systems.

J.P. Knight.

• Engineering 97.587W1 (ELG6387)

Microprocessor Electronics

This course introduces the student to the analysis and design of a microprocessor-based system, integrating the three design aspects: signal representation and processing, hardware and software. Topics discussed are stochastic processes, digital signal representation (as applied to a microprocessor system design), conversion and arithmetic errors, real-time applications software support, micro-architecture of VLSI systems, innovative modern micro- and DSP-processors, bit slices,

A/D and D/A converters, controller chips. Students will be given design examples and prepare their own microcomputer system designs.

Prerequisite: Engineering 97.476 or equivalent.

T.A. Kwasniewski.

- Engineering 97.588F1 (ELG6388)

Signal Processing Electronics

Signal processing from the viewpoint of analog integrated circuit design. CCD's, transversal filters, recursive filters, switched capacitor filters, with particular emphasis on integration of analog signal processing techniques in monolithic MOS ICs. Detailed op amp design in CMOS technology. Implications of nonideal op amp behaviour in filter performance. Basic sampled data concepts, detailed Z transform analysis of switched capacitor filters, oversampled A/D converters and more complex circuits. Noise in analog and sampled analog circuits, including calculation of dynamic range and signal to noise ratio.

M.A. Copeland.

- Engineering 97.589F1, W1 (ELG6389)

Advanced Topics in Electronics

A course dealing with selected advanced topics of recent interest in the broad field of solid state devices, electronic circuits, and electromagnetics. Specified topics to be announced each year. Course usually given on a seminar basis with student presentations on assigned topics.

- Engineering 97.590F1, W1, S1

Engineering Project I

A one-term course, carrying half-course credit, for students pursuing the course work M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 97.591F2, W2, S2

Engineering Project II

A one-term course, carrying full-course credit, for students pursuing the course work M.Eng. program or the co-operative M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 97.596F1, W1, S1

Directed Studies

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

- Engineering 97.599F4, W4, S4
M.Eng. Thesis

- Engineering 97.699F, W, S
Ph.D. Thesis

Department of Systems and Computer Engineering

Mackenzie Bldg. 377
788-5740

The Department

Chair of the Department: S.A. Mahmoud
Departmental Supervisor of Graduate Studies:
A.U.H. Sheikh

The Department of Systems and Computer Engineering offers programs of study and research leading to the M.Eng. and Ph.D. degrees in Electrical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Electrical Engineering which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the Department of Electrical Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 12.

A program leading to the M.Sc. degree in Information and Systems Science is offered in co-operation with the Department of Mathematics and Statistics and the School of Computer Science at Carleton University. This program is more fully described on page 142 of this calendar.

In addition certain faculty members in the department are members of the Ottawa-Carleton Institute for Computer Science, which offers a program leading to the M.C.S. degree. This program is more fully described on page 160 of this calendar.

The departmental program centers upon the analysis and design of systems whose primary function is the processing of information. Within this context, seven interrelated areas of study receive major attention:

- Computer Communications and Database Systems
- Communications and Signal Processing
- Computer Systems Engineering
- Modelling, Simulation, Optimization and Control
- Image Processing
- Knowledge-based Systems
- Software Engineering

An integrated course program provides students with the fundamental basics, and allows specialization in one or more of the above areas as desired. The research program emphasizes the development and application of modern methods of information systems engineering pertinent to these areas. Work undertaken includes both theoretical studies and the related problems of practicable realizations.

Computing systems play a central role in the research and teaching activities of the department. The facilities available to the student include interactive time-sharing and remote batch terminals linked to the

University's Honeywell Level 66 digital computer and several small- to medium-sized computers available within the department. These include a VAX 11/750, over 15 SUN workstations on an Ethernet local area network, and many other stand-alone and network microcomputer workstations. Applications include information storage and retrieval, communications, signal processing, computer system design, and studies of office automation. A Sperry Explorer workstation is used for studies in expert systems and artificial intelligence.

Full advantage is taken within the department of the technology-oriented government/industry/university complex in the Ottawa area. Co-operative projects exist with the Department of Communications, Communications Research Centre, NRC, Bell Northern Research Laboratories, Gandalf, DY 4, Bell Canada and Canadian Workplace Automation Research Centre.

The department is a major partner in the Ottawa-Carleton Centre for Communications Research (OCCCR), which is a multidisciplinary interdepartmental research group comprising faculty members, full-time research staff, postdoctoral fellows, visiting researchers, graduate students, and support staff from both Carleton University and the University of Ottawa. It is part of the Centre of Excellence "TRIO" (Telecommunications Research Institute of Ontario). Current research areas of the Centre with major participation from our department are: integrated services digital networks, methods for telecommunications software, mobile and portable wireless networks, and VLSI in communications.

Students wishing to pursue a computing specialization in systems engineering may be required to take appropriate undergraduate computing science courses for which credit may be allowed.

Graduate Courses*

- Engineering 94.501W1 (CSI5120)

Simulation and Modelling

Simulation as a problem-solving tool. Mathematical foundations: random variate generation, parameter estimation, confidence interval, simulation algorithm. Simulation languages: SLAM, SIMULA, SIMSCRIPT. Examples: computers and protocols, urban traffic, harbours and airport capacity planning, manufacturing capacity planning, inventory systems.

- Engineering 94.504F1 (ADM6371)

Computer Methods in Industrial Engineering

An introduction to algorithms used for decision-making in complex systems. Topics include linear programming, (with duality and post-optimality analysis), nonlinear programming, network models, PERT, integer programming, dynamic programming, queueing systems and inventory theory. Problem-solving is emphasized.

J.W. Chinneck.

- Engineering 94.505W1 (CSI5150)

Optimization Theory and Methods

A second-level course in optimization theory and computer-oriented optimization methods. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programming: Kuhn-Tucker conditions, saddle point theory and dual problems, computational techniques. Application to nonlinear engineering system identification, network synthesis problems, filter design. Function space techniques and introduction to optimal control.

Bernard Pagnurek.

- Engineering 94/95.507F1 (CSI5307)

Expert Systems

This course will include: survey of some landmark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.

Prerequisite: Computer Science 95.407 or 95.501 or Permission of the Department.

W.R. LaLonde.

- Engineering 94.511W1 (ELG6111)

Computer System Design for Performance

Methods for deriving quantitative design parameters within an architectural and configuration framework to meet design requirements on performance parameters, such as the throughput capability or response time of a system. Applications to embedded systems (signal processors, switches, etc.), multi-user systems, and tightly and loosely coupled distributed processors.

Prerequisites: Engineering 94.553 or ELG5119 and 94.574 or equivalent, and a course in computer architecture.

C.M. Woodside.

- Engineering 94.517W1 (ELG6117)

Queueing Systems

Stochastic processes: Markov chains, discrete birth-death, etc. Queueing systems: M/G/1, H/M/M, JUM/D/1/M, etc. Priority queues. Petri nets modelling and Markov chains. Networks of queues: local/global balance equations, product form solutions for open and closed networks. Mean value analysis, diffusion approximation, non-product form networks. Numerical solutions. Examples include throughput analysis from multiprocessors and computer-communication networks.

- Engineering 94.518W1 (ELG6118)

Topics in Information Systems

Students participate in a group project designing and developing an expert system of significant size in an organized manner. Specification of the system's aims, design in terms of knowledge representation, knowledge acquisition and knowledge use, prototyping, implementation and testing will all be covered in a mix of lectures, interactive tutorials and project assignments.

Prerequisites: Engineering 94/95.507 or 94.583 or equivalent.

- Engineering 94.519W1 (ELG6119)

Teletraffic Engineering

Congestion phenomena in telephone systems, and related telecommunications networks and systems, with an emphasis on the problems, notation, terminology, and typical switching systems and networks of the operating telephone companies. Analytical queueing models and applications to these systems.

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

- Engineering 94.521F1 (ELG6121)

Computer Communication

Types of computer networks, performance criteria. OSI Layered Model with emphasis on transport, network and data-link layers. Examples of public networks. Routing and protocol efficiency. Queueing and analysis of networks. Local area networks, protocols and performance analysis of CSMA-CD, token passing and polling.

Prerequisite: Knowledge of probability theory including functions of a random variable or Engineering

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

94.553 or ELG5119 or the equivalent (may be taken concurrently).

Exclusion: ELG 5374 (92.567).

• Engineering 94.527W1 (ELG6127)

Distributed Processing Systems

Methods for representing distributed systems: languages (CSP, SDL, augmented C), communicating state-machine models, and Petri-nets. Analysis of distributed system behaviour, based on these models. Protocols: theory, practical limitations, specification and validation techniques, layered structure. ISO protocol model: transport session, presentation and application levels, the Estelle language. Design examples: interprocess communications, file transfer, factory automation.

Prerequisite: Engineering 94.521 or ELG 5374; and 94.571.

C.M. Woodside.

• Engineering 94.531F1 (ELG6131)

System Design with ADA

Structured design of embedded computer systems with ADA. Requirements of a design language. Overview of ADA. Structured design principles. Notation and mechanisms for structured design with ADA. Canonical system structures. Design examples and issues drawn from areas of current interest, including intelligent terminals and computer communication protocols. Advanced ADA issues. Approaches to CAD. Implementation issues. Emphasis of this course is on design with ADA rather than on learning to program in ADA. However, students interested in ADA programming may be given the opportunity of working with an ADA development system.

Prerequisites: Real-time systems experience such as given by Engineering 94.433 and experience with at least one structured, high-level language, preferably PASCAL.

• Engineering 94.532W1 (ELG6132)

Systems Design

A comprehensive design methodology for implementing systems using VLSI components is expounded and illustrated. It establishes and illustrates this using digital signal processing as a case study. The first part of the course establishes the overall methodology, and places it in perspective with many existing approaches. It then systematically illustrates each step from user requirements, to logical design, to algorithm partitioning and architectural allocation. Examples include designs using existing components, as well as considerations for user-defined chips.

Prerequisites: Engineering 94.558 (or equivalent).

B.A. Bowen.

• Engineering 94.533F1 (ELG6133)

Digital Systems Engineering

This course is concerned with the totality of activity involved in creation of a digital system. It includes as

components both hardware and software engineering, and extends these disciplines to an overall system. Topics include system design methodologies and strategies; representation and discipline mechanisms; constraints; reporting and documentation; interface to manufacturing; quality assurance and maintenance; design reviews; sub-specifications of software and hardware, and their integration and control. Examples are drawn from areas such as signal processing, computer communications, and intelligent terminals.

Prerequisite: Engineering 94.532.

B.A. Bowen.

• Engineering 94.535F1 (ELG6135)

Representations and Methods in Design Tools for Concurrent Systems

New tool products, emerging tool prototypes, and underlying methods for requirements analysis and design of real-time and distributed systems. Visual vs. textual representations, informal vs. formal representations, behaviour validation before implementation, seamless, behaviour-preserving transformations: requirements analysis through design to implementation; implications of different target programming languages; practical reality of software-CAD. Tools to be examined include Statemate, Teamwork, CAEDE and its clones, and others as available. Behavioural methods to be examined include LOTOS, StateCharts, MultiLog, and others as available. Formal methods to be related to these tools include path expressions, constrained expressions, state machines, petri nets, temporal logic, traces. Target languages to be examined include Ada and Occam.

Prerequisite: Permission of the department.

R.J.A. Buhr.

• Engineering 94.538F1 (ELG6138)

Computer Architecture and Parallel Processing

Introduction to parallel processing; parallel computer structures; memory and input/output subsystems; pipelining and vector processing; array processing; data flow and systolic computations; interconnection networks; software and other design fundamentals; examples.

Prerequisite: Engineering 94.457 or equivalent.

• Engineering 94.539F1, W1 (ELG6139)

Advanced Topics in Digital Systems Design

A course dealing with recent and advanced topics in the field of digital systems design and related areas. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Engineering 94.533 or ELG5119 or the equivalent and permission of the department.

B.A. Bowen.

- Engineering 94.540W1 (ELG6140)

Topics in Office Automation

The course examines office technology from three points of view: the technology, the individual user and the organization. Selected technologies, human-machine interaction, the organization and productivity. Selected topics from recent research papers with emphasis on applications of knowledge systems. Students will undertake a substantial project either individually or in groups as part of the course.

Prerequisite: Permission of the department. Students should have completed several graduate courses or have had previous experience of technology in the office and have a good knowledge of computers.

A.R. Kaye.

- Engineering 94.541F1 (ELG6141)

Adaptive Control

Analysis of nonlinear dynamic systems with emphasis on stability. Lyapunov and hyperstability theories. Introduction to system identification. The least squares and recursive least squares approaches. Model reference adaptive control. The self tuning regulator. Issues in parameter convergence and stability. Robustness properties of adaptive systems. Case studies will include applications to process control and robotics. Students will be required to prepare a critical review of the current literature.

Prerequisite: Engineering 94.552 or equivalent.

H.M. Schwartz.

- Engineering 94.542F1 (ELG6142)

Advanced Dynamics With Applications to Robotics Kinematics of rigid bodies and robot manipulators. Use of the Denavit-Hartenberg principle. Forward and inverse kinematics of manipulators. Momentum and energy principles. Lagrange equations and Hamilton's principle. Dynamics of lumped parameter and continuous systems. Natural modes and natural frequencies. Forced vibrations. General dynamics of robot manipulators.

H.M. Schwartz.

- Engineering 94.552F1 (ELG6152)

Advanced Linear Systems

Review of basic linear systems: input-output relations, superposition, impulse response, convolution. Transform methods in systems analysis. Fourier and Laplace transforms. Time-frequency relationships. Discrete time systems, the Z transform. State space representation of the systems: basic concepts, canonical realizations. Observability and controllability of continuous and discrete time realization. Solution of state equations and modal decomposition. Linear state variable feedback and modal controllability. Abstract approach to state space realization methods. Geometric interpretation of similarity transformations.

H.M. Schwartz.

- Engineering 94.553F1, W1 (ELG6153)

Stochastic Processes

Basic concepts of randomness, as applied to communications, signal processing, and queueing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queueing theory.

Exclusion: ELG 5119 (92.519)

H.M. Hafez.

- Engineering 94.554F1 (ELG6154)

Principles of Digital Communication

Digital communication systems: characterization of information and noise signals; source encoding; communication processes; basic decision theory; optimum receivers. System performance; delay distortion, amplitude distortion, intersymbol interference, additive noise. Common digital modulation systems.

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent (may be taken concurrently).

Exclusion: ELG 5375 (92.556)

H.M. Hafez.

- Engineering 94.557F1 (ELG6157)

Fundamentals of Discrete Systems

Introduction to the theory and applications of discrete mathematics to the analysis and design of computer algorithms and data communication systems. Group theory and application to finite state machines; algebras and combinatorial logic design; homomorphic maps and application to group codes; rings and fields and their application to cyclic codes. Graph and tree structures, directed graphs; classes of polynomial and complete and incomplete problems with graph representation.

S.A. Mahmoud.

- Engineering 94.558F1 (ELG6158)

Digital Systems Architecture

New architectural concepts in the design of computer systems are introduced. Discussions include system building blocks (arithmetic units, central processing units, control units, input/output and memory devices) and methods to achieve speed-up (instruction look-ahead, pipelining, memory interleaving, associative memory, SIMD and MIMD multiprocessing). Examples of current computer systems are used for discussions.

Prerequisite: Engineering 94.457 or equivalent.

- Engineering 94.560W1 (ELG6160)

Adaptive Signal Processing

Theory and techniques of adaptive filtering, including gradient and LMS methods; adaptive transversal and lattice filters; recursive least squares; fast recursive least squares; convergence and tracking performance; systolic array techniques. Applications, such as adaptive prediction, channel equalization; echo cancellation;

speech coding; antenna beamforming; system identification in control systems; spectral estimation; neural networks. Students will do extensive reading of current literature and present a seminar.

Prerequisites: Engineering 94.553 or ELG5119 or equivalent; Engineering 94.562 or ELG5376 or equivalent.

D.D. Falconer, W.F. McGee.

• Engineering 94.562F1 (ELG6162)

Digital Signal Processing

Signal representations, Z transform and difference equations. Theory, design of FIR, IIR filters. Discrete Fourier transform: properties, implementation via fast algorithms (radix-m FFT, PFA, WFTA). Chirp-z transform. Cepstral analysis. Decimation/interpolation. Random signal analysis: estimators, averaging, correlation, windowing. Input/output and quantization effects. Application overview: Analog-digital converters (linear, companded), digital audio (CD, DAT), speech analysis and synthesis. Programmable DSP microcomputers: contemporary commercial architectures, application to implementation of DSP algorithms. Case studies: Linear predictive coding of speech (LPC), radix-4 FFT, spectrograph.

Prerequisites: Engineering 94.552, 94.553 or ELG5119 or the equivalent (may be taken concurrently).

Exclusion: ELG 5376 (92.557)

L.R. Morris.

• Engineering 94.563W1 (ELG6163)

Digital Signal Processing Hardware, Software, and Applications

Digital signal processing (DSP) algorithm structure. Architectural features of general purpose, RISC, and DSP computers. Data representation, addressing, and arithmetic processing. Contemporary single (TMS320C25), dual (DSP 56000), and multiple (TM320C30) accumulator/operand commercial architectures. Algorithm/software/hardware architecture interaction. Programming techniques and program examples. Software development cycle. Hardware and software development tools. Program activity analysis techniques. Case studies: Linear predictive vocoder, DFT, Echo cancellation. Interfacing and input/output. Codecs. Microprogrammable bit-slice processors, application specific chips (ASIC): Pro's/con's vs. programmable DSP processors.

Prerequisite: Engineering 94.562 or ELG 5376 or the equivalent.

L.R. Morris.

• Engineering 94.564W1 (ELG6164)

Advanced Topics in Digital Signal Processing: Speech Communications and Applications

Mathematics of signal processing. Digital filtering. Anatomy and physiology of speech production. Articulatory and acoustic phonetics. Speech production.

Vocal tract models. The ear and auditory perception. Speech perception, modelling, and time/frequency domain analysis/synthesis. Sub-band, homomorphic, and linear predictive coding techniques. Vocoders: formant, LPC (pitch, multi-pulse, residual excitation); implementation issues. Speech and speaker recognition. Commercial special purpose chip-based speech analysis/synthesis systems. Programmable DSP's. Case studies: LPC and formant-based analysis/synthesis, pitch extraction on TMS 320 family.

Prerequisite: Engineering 94.562 or ELG 5376 or the equivalent.

L.R. Morris.

• Engineering 94.565W1 (ELG6165)

Advanced Digital Communication

Review of optimum reception for the non-distorting additive noise channel; intersymbol interference and equalization; efficient digital modulation techniques; timing and synchronization; discussion of selected topics, such as partial response, error detection and correction, multiple-access communication, spread spectrum modulation; information theory.

Prerequisite: Engineering 94.554 or ELG5375 or the equivalent.

D.D. Falconer.

• Engineering 94.567F1 (ELG6167)

Source Coding and Data Compression

Discrete and continuous sources: the rate distortion functions. Discrete source coding: Huffman coding, run length encoding. Continuous source coding: waveform construction coding; PCM, DPCM, delta modulation; speech compression by parameter extraction; predictive encoding; image coding by transformation and block quantization. Fourier and Walsh transform coding. Compression by tree coding. Applications to telecommunication signals and storage; speech, television, facsimile.

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

D.D. Falconer.

• Engineering 94.568W1 (ELG6168)

Mobile Communications Systems

Channel characterization: multipath interference, Rayleigh fading, shadowing effects, selective fading, impulsive noise. Diversity techniques. Analog land mobile systems: FM and SSB systems. Digital land mobile systems: bit and block error rates, digital modulation systems, digitized speech signals. Conventional land mobile networks: trunked networks, access schemes. Cellular land mobile systems. Interference analysis for analog and digital systems.

Prerequisite: Engineering 94.554 or ELG5375 or the equivalent.

A.U.H. Sheikh.

- Engineering 94.569W1 (ELG6169)

Digital Television

Colour television theory: standard systems: NTSC, PAL, SECAM; composite and component signals. Sampling and quantization of television signals. Bandwidth compression: decimation; predictive, transform and hybrid coding. Digital cameras, studios, switching, special effects, recording, transmission and receivers. Evaluation methods.
D.C. Coll.

- Engineering 94.571F1 (CSI5117)

Mini/Microcomputer Operating System Design

Principles and practice of structured operating system design with emphasis on real-time, embedded systems. Concurrent programming: mechanisms and languages; design approaches and issues; run-time support requirements (kernel); I/O handling. Embedded vs. general purpose operating systems. Distributed operating systems. Examples drawn from ADA, RMX, VRTX, Harmony, Unix, VMS and others. Programming assignments will be in a suitable language.

Prerequisite: Engineering 94.433* or equivalent (course or experience), PASCAL or similar programming experience.

- Engineering 94.573F1 (CSI5115)

Integrated Database Systems

Database definitions, objectives and applications, standard architectures, e.g. ANSI/SPARC architecture; database design process; data dictionary; the entity-relationship model. Network model; the relational approach, relational algebra and calculus, normal forms; hierarchical model. Design and integration issues in database machines, distributed database and knowledge base systems.

Prerequisite: Engineering 94.574 or equivalent.

- Engineering 94.574F1 (ELG6174)

Elements of Computer Systems

An overview of basic computer topics which some engineering students may not have covered in their undergraduate programs. Subjects covered include: concepts in computer architecture: 80X86 architecture, assembler, instruction types, addressing modes, memory organization, and debugging. Structures languages: scope rules, dynamic allocation of data, data types, control structures, subroutines. Data structures: stacks, queues, linked lists, binary trees. Multitasking operating system concepts: task interference, busy waiting, TAS hardware, deadlock, task scheduling and synchronization, semaphores, producer/consumer problem, monitors. This course is designed for graduate students without extensive undergraduate preparation in computer engineering (or the equivalent experience). Students with the equivalent of a bachelor's degree in electrical or computer engineering, or computer science, would normally proceed directly to courses for which 94.574* is a prerequisite.

Prerequisite: Programming experience in at least one high level language and some experience in assembly language programming.

L.R. Morris.

- Engineering 94.576F1 (ELG6176)

Analytical Performance Models of Computer Systems
Analytical modelling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queueing network models, together with a treatment of computational techniques, approximations, and limitations. Applications include scheduling, memory management, peripheral devices, databases, multiprocessing, and distributed computing.

Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

C.M. Woodside.

- Engineering 94.577W1 (ELG6177)

Teleprocessing Software Design

Review of teleprocessing applications, functions and devices. The session, presentation and application layers of the Open System Interconnection Model. Examples: Electronic Mail systems and Distributed Data Bases. Teleprocessing Software Design using high level procedural languages: Concurrent Pascal and ADA. SNA protocols and systems: layering concepts in SNA; distribution of teleprocessing functions and software components. Relationship between SNR and OSI models. Examples of Distributed Teleprocessing Networks and applications in SNA.

Prerequisites: Engineering 94.521 or ELG 5374; and 94.574; or the equivalents.

S.A. Mahmoud.

- Engineering 94.579F1, W1 (CSI5112)

Advanced Topics in Software Engineering

A course dealing with recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Engineering 94.531 and permission of the department.

- Engineering 94.581F1 (ELG6181)

Advanced Topics in Computer Communications

Recent and advanced topics in computer-communication networks intended as a preparation for research. Students are expected to contribute to seminars or present lectures on selected topics.

Prerequisites: Engineering 94.521 or equivalent and permission of the department.

A.R. Kaye.

- Engineering 94.582F1 (ELG6182)

Introduction to Information and Systems Science

An introduction to the process of applying computers in problem-solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queueing systems, optimization.

(Also offered as Mathematics 70.582, Computer Science 95.582 and Information and Systems Science 93.582)

- Engineering 94.583W1 (ELG6183)

Logic Programming

Review of relational databases, first order predicate calculus, semantics of first order models, deductive querying. Proof theory, unification and resolution strategies. Introduction to Prolog, and/or parallelism and Concurrent Prolog. Applications in knowledge representation and rule based expert systems.

Prerequisites: Previous knowledge of databases (as gained in Engineering 94.304* or 94.573) would be helpful.

Bernard Pagurek.

- Engineering 94.584F1, W1 (ELG6184)

Advanced Topics in Communications Systems

Recent and advanced topics in communications systems. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Permission of the department.

- Engineering 94.585W1 (ELG6185)

Logic Programming: Techniques and Applications

Advanced programming techniques for selected applications of logic programming: language translators, interpreters, expert systems. Prolog language: review of basic logic programming techniques, language features, date representation. Program design: design principles, graphical design notation, paradigms, and methodology. Advanced techniques include: searching, grammars, meta-interpreters, incomplete structures. Implementation of Prolog. Each student is expected to complete a substantial project as part of the course requirements.

Prerequisite: Engineering 94.583 or the equivalent (students are expected to be familiar with Edinburgh-style Prolog).

G.M. Karam

- Engineering 94.589W1 (ELG6189)

Advanced Topics in Measurements and Models

Recent and advanced topics in optimization, queueing theory, dynamic systems, estimation for systems analysis, the theory of networks, and similar areas. A seminar course for Ph.D. students and (with permission) advanced master's students.

C.M. Woodside.

- Engineering 94.590F1, W1, S1

Systems Engineering Project

Students pursuing the non-thesis M.Eng. program will conduct an engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

- Engineering 94.591F2, W2, S2

Systems Engineering Project

Project similar to Engineering 94.590, but either of greater scope or longer duration. Results will be given as a typewritten report and presented in a seminar.

- Engineering 94.592T2

Systems Engineering Project

(Same description as Engineering 94.591, but spread over two terms)

- Engineering 94.593F2, W2, S2

Co-operative Program Project

A one-term course, carrying a full-course credit, for students pursuing the co-operative M.Eng. program. An engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 70/94/95.595F4, W4, S4

M.C.S. Thesis

- Engineering 94.596F1, W1, S1 (ELG6196)

Directed Studies

- Engineering 70/93/94/95.598F3, W3, S3

M.Sc. Thesis in Information and Systems Science

- Engineering 94.599F4, W4, S4

M.Eng. Thesis

- Engineering 94.699F, W, S

Ph.D. Thesis

Department of Electrical Engineering

University of Ottawa
564-2494

The Department

Chair: G.I. Costache

Graduate Programme Co-ordinator: M.M. Ney

The Department of Electrical Engineering is one constituent of the Ottawa-Carleton Institute for Electrical Engineering. Consult the Institute entry in this calendar for a faculty list, graduate programme descriptions and admission requirements.

Department Facilities

Computing Facilities

The main computer operated by the Department is a VAX 11/750 running the VMS operating system. This machine is equipped with a 452 MB disk drive, a high speed tape drive, and 3 MB of main memory. The available software currently includes a Fortran-77 compiler, the D-PICT graphics package, various CAD packages, and cross-assemblers for several popular microprocessors. The Department also has two PDP-11/34 minicomputers running RSX11-M, one of which is equipped to operate as a real-time system. In addition, the Department has several microprocessor systems, including four Intel 310 development systems running IRMS and MS-DOS, and EMULOGIC development system capable of real-time in circuit emulation of several popular microprocessors, several IBM PC's, and a variety of single board microcomputer systems available for both teaching and research. The Department also has access to the University's AMDAHL mainframes (running CMS) via a SYTEK local-area network, which also interconnects several of the Department's computers.

The computer-aided design facilities include the CAD Laboratory of the Faculty which is equipped with a VAX 11/780, 16 graphics terminals, and various CAD packages; and a DAISY VLSI work station for the design and simulation of VLSI and logic circuits.

Digital Communications Research Laboratory

This laboratory features a 14/12 GHz satellite earth station and a 2 GHz digital microwave system for on-line real system tests. The laboratory is well equipped with the latest digital communications equipment and computer facilities, including pseudo-random generators, error probability computers, Gaussian noise generators, digital modulators, demodulators, error correcting codecs, auto and cross correlators and a probability density computer (100 bits/sec.-150 Mbits/sec.).

Computer-Communications Research Laboratory

The laboratory is equipped with a PDP 11/34 mini-computer and several microprocessors. Recent activities include the development of PLATON, a CSMA/CD local-area network, the design of packetized digital voice hardware simulator, the development of integrated data/voice stations for local-area networks, the design and implementation of test-bed facility for data/voice/image integration over local area networks with particular application in interactive teleradiology.

Electromagnetic Research Laboratory

This laboratory is equipped with modern coaxial line and waveguide instruments covering frequencies from 10 MHz to 40 GHz. A computer-controlled frequency domain network analyzer with error correcting capabilities allows reflection and transmission measurements from 5 Hz to 26.5 GHz. The laboratory is also equipped with a computer-controlled time domain network analyzer and a modern scalar network analyzer (transmission, reflection test set) as well as various frequency counters and spectrum analyzers. A computer controlled three-dimensional scanning system located in an anechoic chamber and used for near-field antenna measurements and electromagnetic dosimetry studies in the frequency range from 100 MHz-3 GHz is also available.

Graduate Courses*

- Engineering 92.504 (ELG5337)
Electronics Design Techniques with Integrated Circuits
Review of basic operational amplifier techniques. Design of specialty circuits: wideband low noise video amplifiers, chopper amplifiers, isolation amplifiers, and switched capacitor filters. Review of phase locked loops. Filter design using phase locked loops. Operation and use of surface acoustic wave devices and charge coupled devices.
Prerequisite: ELG4131 or the equivalent.
D.T. Gibbons.
- Engineering 92.506 (ELG7132)
Topics in Electronics I
Current topics in the field.
Staff.
- Engineering 92.507 (ELG7133)
Topics in Electronics II
Current topics in the field.
Staff.

*All courses offered are half-course credits.

• Engineering 92.508 (ELG7575)

Sujets choisis en électronique

Sujets d'intérêt courant dans la matière.

Personnel.

• Engineering 92.516 (ELG5113)

Stochastic Systems

Wiener processes. Poisson random measures. Stochastic Wiener-Ito integrals. Stochastic integrals with respect to Poisson measures. Stochastic differentials. Diffusion processes. Ito-stochastic differential equations: existence and uniqueness of solutions, continuous dependence of solutions with respect to parameters. Semigroup theory and generation of semigroups as applied to stochastic differential equations. Applications to engineering systems modelling (computer communications networks, power system networks, etc.).

Prerequisite: Permission of the instructor.

N.U. Ahmed.

• Engineering 92.519 (ELG5119)

Stochastic Processes

Probability spaces. Random variables. Distribution and density functions. Expectation. Functions of random variables. Moments and characteristic functions. Random vectors. Functions of random vectors. Sequences of random variables. Convergence notions. The central limit theorem. The law of large numbers. Stochastic processes: basic notions, characterizations and examples. Stationarity notions. Poisson processes. Gaussian processes. Transformations of stochastic processes. Ergodicity. Second order random processes. Representation theorems. Markov processes. Homogeneous Markov chains. Applications.

Exclusion: 94.553

P. Galko.

• Engineering 92.526 (ELG5353)

Distributed Parameter Systems

First and second order evolution equations on Banach spaces. Controllability and stability of hyperbolic systems. Identification of system parameters. Application to flexible spacecraft.

Prerequisite: Permission of the instructor.

N.U. Ahmed.

• Engineering 92.527 (ELG5161)

Robotics: Control, Sensing and Intelligence

Robotics as the intelligent connection of perception to action. Robotics in the CIM context. Advanced robotics technologies. Robot arm kinematics and dynamics. Planning of manipulator trajectories. Control of robot manipulators. Robot-level programming. Sensors and sensory perception. Control problems for sensory controlled robotic-based flexible manufacturing systems. Task-level programming. Mobile robots. Knowledge-based control for mobile robots: environment perception, robot's world model, navigation and motion control.

Prerequisite: ELG4161 or the equivalent.

E. Petriu.

• Engineering 92.528 (ELG5160)

Introduction to Robotics

Introduction to robots and their applications. Types of robots. Power sources: hydraulic, pneumatic and electric systems. Representation of robot kinematics and dynamics. Planning and execution of manipulator trajectory. Feedback from the environment: the use of sensors and artificial vision. Real-time computer control. Programming languages and programming aspects. Application case studies.

Prerequisites: ELG4151 and ELG4161 or the equivalents.

Staff.

• Engineering 92.529 (ELG7113)

Topics in Systems and Control I

Current topics in the field, including linear semigroup theory and optimal feedback control.

Staff.

• Engineering 92.530 (ELG7114)

Topics in Systems and Control II

Current topics in the field, including linear and nonlinear filtering and optimal control of stochastic systems.

Staff.

• Engineering 92.531 (ELG7574)

Sujets choisis en systèmes et réglage automatique

Personnel. Sujets d'intérêt courant dans la matière.

• Engineering 92.534 (ELG5101)

Millimeter-Wave Engineering and Applications

Techniques for generating, transmitting and receiving millimeter waves. Propagation characteristics of millimeter-waves in the atmosphere and other media. Tube and solid state sources; antennas; transmission media; waveguide circuits and components. Millimeter-wave systems and applications for radar, communications, radiometry, remote sensing and radio astronomy.

Prerequisites: ELG4101 and ELG4102 or the equivalents.

P. Bhartia (DREO) and W.J.R. Hofer.

• Engineering 92.535 (ELG5108)

Electromagnetic Compatibility and Interference

Interference phenomena. Shielding of conductors. Grounding. Other noise reduction techniques. EMI filters. Noise sources: narrowband and broadband. Electromagnetic pulse as an interference source. Modelling EMI/C circuit boards and backplanes.

Prerequisite: ELG4101 or the equivalent.

G. Costache and P. Bhartia, DREO.

• Engineering 92.538 (ELG7500)

Sujets choisis en électromagnétisme

Sujets d'intérêt courant dans la matière.

Personnel.

• Engineering 92.540 (ELG5109)

Radio-, Micro- and Millimeter Wave Measurements and Instrumentation

Fundamentals of electronic measurements, uncertainty analysis. Measurements from 10-kHz to 300-GHz: voltage, current, power, frequency, attenuation, phase and Q-factor. Fundamentals of electronic instrumentation: digital voltmeters, power meters, frequency counters, impedance analyzers, network analyzers and spectrum analyzers. Application of computers for measurements: IEEE 488 interface, automatic test equipment. New trends in electronic instrumentation.

Prerequisite: ELG5104 or the equivalent.

S.S. Stuchly.

• Engineering 92.541 (ELG5104)

Electromagnetic Waves: Theory and Applications

The homogeneous wave equation. Uniform and non-uniform plane waves. Inhomogeneous wave equations. Green's functions. Theory of potentials. Scattering problems. Numerical methods. Boundary value problems. Perturbation and variational techniques.

Prerequisite: ELG4101 or the equivalent.

M. Ney.

• Engineering 92.542 (ELG5379)

Numerical Methods in Electromagnetic Engineering
An introduction into modern numerical methods for solving electromagnetic field problems. Deterministic as well as eigenvalue problems will be treated using the following techniques: finite difference and finite element techniques; moment methods; sparse matrix techniques; spectral domain techniques; hybrid mode analysis; transmission line matrix simulations. Applications include wire antennas, waveguides of arbitrary cross-section, microstrip and quasiplanar transmission lines, transmission line discontinuities and computer-aided design and optimization of microwave components.

Prerequisite: ELG4103 or the equivalent.

G. Costache.

• Engineering 92.543 (ELG5504)

Ondes électromagnétiques: théorie et applications
Équation homogène d'onde. Ondes planes uniformes et non uniformes. Équation non homogène d'onde. Fonctions de Green. Théorie des potentiels. Problèmes de diffraction. Méthodes numériques. Problèmes avec frontières limitées. Méthode des perturbations et variationsnelles.

Préalable: ELG4101 ou équivalent.

M. Ney.

• Engineering 92.544 (ELG7100)

Topics in Electromagnetics I

Current topics in the field.

Staff.

• Engineering 92.545 (ELG7101)

Topics in Electromagnetics II

Current topics in the field.

Staff.

• Engineering 92.546 (ELG5779)

Méthodes numériques en génie électromagnétique

Une introduction aux méthodes modernes de résolution numérique de problèmes électromagnétiques. Le cours couvre des problèmes déterministes et aux valeurs propres. Les méthodes suivantes seront présentées: différences finies, éléments finis, analyse dans le domaine spectral, analyse par modes hybrides, méthode T.L.M. Les méthodes seront appliquées aux problèmes suivants: antennes, guides d'onde de section arbitraire, lignes microrubans et lignes quasi-planaires, discontinuités dans les lignes de transmission, conception par ordinateur de composants hyperfréquences.

Préalable: ELG4101 ou équivalent.

G. Costache.

• Engineering 92.549 (ELG5174)

Satellite Communications

Basic up-link and down-link equations. System noise temperature. Power flux density and energy dispersal. Analog frequency modulation techniques. Signal-to-noise ratios for telephony and television. Time division multiple access systems and digital system capacity under bandwidth and power limitations. Single channel per carrier frequency division multiple access schemes and system capacity. Pre-assigned and demand assigned satellite networks. Geometry relating to satellite and earth stations. Earth station figure of merit (G/T) measurement using radio stars. Rain attenuation. System fade margins for linear and saturated transponders. Dual polarization frequency re-use. Interference between terrestrial microwave and satellite systems.

Y.F. Lum (DOC).

• Engineering 92.550 (ELG5371)

Digital Communications by Satellite

Digital interface subsystems between terrestrial and satellite facilities. Echo suppression and cancellation techniques. Transmultiplexers for FDM to TDM conversion. Baseband signal processing techniques for nonlinear satellite modems. Recent developments in digital satellite modulation techniques (OQPSK, modified MSK, differential QPSK with nonredundant error correction, IJF-OKQPSK, etc.) Analysis of cross-talk in hard-limited channels. Fast synchronization techniques for burst-operated (TDMA) satellite systems and single channel per carrier preassigned and demand assigned systems. Regenerative satellite systems.

Prerequisite: ELG 5375 or 94.554 or the equivalent.

A. Yongacoglu.

• Engineering 92.552 (ELG5331)

Transmission Systems for Communications

This course is for engineers involved with the design, application and specification of transmission systems for communications, including voice, data and video information. Topics to be covered include: network fundamentals, signal properties, noise, transmission

media, system impairments, performance objectives; message channels; cable transmission and treatment; analog carrier systems; multichannel system load and testing; nonlinear channels and intermodulation noise; microwave radio systems, FM radio, SSB-FM, satellite systems; digital transmission fundamentals, digital terminals, multiplexers; baseband digital systems, digital cable systems, digital microwave radio systems, digital satellite systems, optical-fiber systems; local area transport; digital signal processing applications, system maintenance.

Prerequisite: ELG4171 or the equivalent.

W.F. McGee.

• Engineering 92.553 (ELG5179)

Detection and Estimation

An introduction to the optimal processing of communication signals. The binary hypothesis testing problem. Bayes risk and Neyman-Pearson criteria based receivers. M-ary hypothesis detection problems. Composite hypothesis problems. Parameter estimation criteria; Cramer-Rao bounds; maximum-likelihood estimation. Function space concepts. Integral equations; the Karhunen-Loeve Expansion Theorem. Detection problems of signals in additive white Gaussian noise. Detection problems in coloured noise; the whitening filter; singular detection. The noise in noise problem. Classical signal estimation problems. The linear filtering problem. The Wiener filter. The Kalman filter. Sequential detection (Wald's test). Introduction to non-parametric detection.

Prerequisites: ELG5119 or 94.553; and ELG5375 or 94.554; or the equivalents.

P. Galko.

• Engineering 92.554 (ELG5372)

Error Control Coding

General introduction. Algebraic concepts. Linear block codes. Cyclic codes, error trapping, decoding of cyclic codes, BCH codes, majority-logic decoding of cyclic codes, finite geometry codes, burst-error correcting codes. Convolutional codes. Maximum-likelihood decoding, sequential decoding, and majority-logic decoding of convolutional codes. Burst-error correcting convolutional codes. Automatic repeat request strategies. Applications of block coding to data storage systems. Applications of convolutional codes.

Corequisite: ELG4171 or the equivalent.

A. Yongacogul.

• Engineering 92.556 (ELG5375)

Digital Communications

Principles of digital communications. Channel characterization. Baseband pulse transmission. Optimization and equalization of the transmission system. Digital modulation techniques. Adaptive equalization techniques. Application of digital filtering techniques to equalization and synchronization.

Prerequisite: ELG4171 or the equivalent.

Corequisite: ELG5119 or 94.553 or the equivalent.

Exclusion: 94.533

W. Steenaart.

• Engineering 92.557 (ELG5376)

Digital Signal Processing

Discrete-time signals, system functions, convolution, correlation, transforms. Frequency domain and Z-domain representations. FIR and IIR filters. Filter design in frequency and time domains. The Discrete Fourier Transform. Fast Fourier Transform algorithms. Realizations: finite word-length effects, quantization of analog signals and filter coefficients, quantization of multiplier and adder outputs, overflow and limit cycles. Decimation and interpolation and their applications. Anti-aliasing filter design. A/D and D/A impairments and specifications. Echo cancellers. The extent to which the above topics are covered will be determined at the beginning of the course based on the student's background.

Exclusion: 94.562

T. Aboulnasr.

• Engineering 92.558 (ELG5776)

Traitement numérique des signaux

Méthodes de traitement numérique des signaux dans le domaine fréquentiel et temporel; effets d'arrondissement sur les coefficients et accumulation des erreurs. Réalisations directes très hautes vitesses. Réseaux systoliques. Réalisations utilisant des micro-ordinateurs. Techniques d'adaptation. Applications aux systèmes de télécommunications.

Préalable: ELG4172 ou équivalent.

W. Steenaart.

• Engineering 92.559 (ELG5378)

Image Processing and Image Communications

Linear systems approach to image processing. Two-dimensional transforms for image processing. Image analysis, segmentation, and classification. Applications to inspection, remote sensing, and medicine. Image coding: spatial domain, transform domain. Properties of the human visual system and image displays. Image processing hardware.

Prerequisite: ELG5376 or 94.562 or the equivalent.

M. Goldberg.

• Engineering 92.560 (ELG7172)

Topics in Signal Processing I

Current topics in the field.

Staff.

• Engineering 92.561 (ELG7173)

Topics in Signal Processing II

Current topics in the field.

Staff.

• Engineering 92.562 (ELG5778)

Traitement et transmission d'images

Applications des systèmes linéaires en traitement d'images. Transformées bi-dimensionnelles et leurs emplois pour le traitement d'images; analyse d'images par segmentation et classification; exemples d'applications en inspection, télédétection et médecine; codage d'images, dans le domaine spatial, des transformées,

méthodes hybrides, caractéristiques du système visuel humain et écrans de visualisation; hardware pour le traitement d'images.

Préalable: ELG5376 ou 94.562 ou équivalent.

M. Goldberg.

- Engineering 92.563 (ELG7179)

Topics in Signal Processing III
Machine Vision.

- Engineering 92.565 (ELG7177)

Topics in Communications I
Current topics in the field.
Staff.

- Engineering 92.566 (ELG7178)

Topics in Communications II
Current topics in the field.
Staff.

- Engineering 92.567 (ELG5374)

Computer-Communication Networks

Introduction. Network goals. Applications of networks. Network structure. Network architectures. The ISO reference model. Introduction to queueing theory. Delay analysis. The physical layer. The data link layer. The network layer: point to point networks, satellite and packet-radio networks, local area networks. The transport and session layers: interconnection of packet switching networks. The presentation layer: network security and privacy, file transfer protocols. The application layer: distributed data base systems.

Corequisite: ELG4171 or the equivalent.

Exclusion: 94.521

N.D. Georganas, O. Yang.

- Engineering 92.570 (ELG5380)

Digital Telephony

The communication process. The telephone network: constituents and principles governing its evolution. Speech processing and applications. VLSI codes and line circuits. Digital transmission principles. Time-division multiplexing, channel banks and transmission systems. Principles of digital switching and exchanges: circuit and packet switching. Architecture alternatives. Stored program control and distributed systems. Switching office service circuits. Reliability, maintainability and evaluation criteria. Comparative analysis of commercial systems. Office communications. Communication workstations. ISDN. Network evolution and network control issues. (Students will be expected to do extensive reading of the current literature and a report and class presentation of an assigned topic.)

Prerequisite: ELG4171 or the equivalent.

S. Cohn-Sfetcu (BNR).

- Engineering 92.571 (ELG5381)

Office Communication Systems

The communication process and office automation quandary. Office models. Office communication system design. Key systems. PBX design principles and

comparative analysis. Local area networks. Fibre optics in the office. Open system interconnect. Inter-network communications. Requirements and architectural alternatives for integrated voice and data communications. LANs and computer to PBX interfaces. Integrated office systems: examples and critical analysis. New communication services: messaging, teleconferencing, document and image communication, directories, etc. Access. Voice terminals. Data terminals. The PC invasion and local services. Portability. Integrated work stations. Man-machine interfaces. The impact of ISDN. Private networks. (Students will be expected to do extensive reading of the current literature and a report and class presentation of an assigned topic.)

Prerequisite: ELG5380 or the equivalent.

S. Cohn-Sfetcu (BNR).

- Engineering 92.572 (ELG7572)

Sujets choisis en télécommunications et traitement de signaux

Sujets d'intérêt courant dans la matière.

Personnel.

- Engineering 92.573 (ELG5194)

Design and Testing of Reliable Digital Systems

Introduction. Test generation for combinatorial circuits. Fault detection in sequential circuits. Memory testing. LSI/VLSI circuit testing. Deterministic and random testing of digital circuits. Design for testability. Self-checking circuits. Design of fault-tolerant systems. Case studies.

Prerequisite: ELG5195 or the equivalent.

S.R. Das.

- Engineering 92.574 (ELG5180)

Advanced Digital Communications

Representation of baseband and bandpass signals. Coherent and noncoherent demodulation. Nyquist criteria. Gaussian noise. Error rates. Fading channels: modelling and error rates. Optical receiver modelling and error rates. Design and performance of optimal receivers: linear, decision feedback, and maximum likelihood receivers. Behaviour of cascaded digital systems: timing recovery problems. Emphasis on computer-aided design.

Prerequisites: ELG5119 or 94.553; and ELG5375 or 94.554; or the equivalents.

Exclusion: 94.565

W.F. McGee.

- Engineering 92.575 (ELG5195)

Digital Logic Design: Principles and Practices

Combinational circuit analysis including hazard detection. Number systems and codes. Switching algebra. Combinational circuit design including PLA and MSI techniques. IC logic families. Flip-flop properties. Switching algebra: special properties — symmetric functions,unate functions, threshold functions, Boolean difference, and functional decomposition. Intro-

duction to sequential circuits — state reduction, incompletely specified machines, state assignment, and series-parallel decomposition. Fundamental mode sequential circuits — race, hazards, and state assignment. Testing aspects of digital systems — failure and fault models, deterministic test generation for combinational circuits, testing sequential circuits, state identification, and testing memories and complex LSI/VLSI circuits. Design for testability techniques: scan techniques, built-in self-test (BIST), and easily testable network structures. Semicustom and MSI design. Special sequential circuits including sequential integrated circuits.

S.R. Das.

• Engineering 92.576 (ELG5335)

Analogue Filter Theory and Design

Network analysis. Algebraic properties of network functions. Active and passive networks. Analytic properties of passive networks. Impedance and positive functions — properties and realization. Transfer functions — approximation and realization. Singly- and doubly-terminated lossless networks. Series-parallel and cascade realization. Emphasis in the course will be on circuits for communications.

Prerequisite: Familiarity with linear system analysis and the theory of analytic functions.

W.F. McGee.

• Engineering 92.577 (ELG5192)

Microprocessor-Based Systems

The course considers the various design alternatives of microprocessor based systems. Review of current microprocessor trends. Design alternatives of microprocessor-based system executives. LSI memories and memory system design. Input/output options and the design of various input/output ports. Busing schemes. Design of bit-sliced systems.

Prerequisite: ELG4391 or the equivalent.

M. Krieger.

• Engineering 92.578 (ELG5193)

Multi-Microprocessor Systems

Multiprocessor systems: definitions, characteristics, objectives and applications. Multi-processor systems: what, where and why. Task-driven systems. Examples of multi-microprocessor systems. (Students will be expected to do extensive reading of the current literature, a project and class presentation of an assigned topic.)

Prerequisite: ELG5192 or the equivalent.

M. Krieger.

• Engineering 92.587 (ELG7186)

Topics in Computers I

Current topics in the field.

Staff.

• Engineering 92.588 (ELG7187)

Topics in Computers II

Current topics in the field.

Staff.

• Engineering 92.590 (ELG7573)

Sujets choisis sur les ordinateurs

Sujets d'intérêt courant dans la matière.

Personnel.

• ELG6000

Engineering Report/Rapport technique

For students in the course work master's program working on the Engineering Report. Pour les candidats à la maîtrise qui préparent un rapport technique.

• ELG7999

M.A.Sc. Thesis/Thèse de M.Sc.A.

For students working towards their master's thesis. Pour les étudiants qui travaillent à leur thèse de maîtrise.

• ELG8000

Co-Op Work Term I/Travail coopératif Ier trimestre

For students in a co-operative master's program who are on their first work term. Pour les candidats à un programme coopératif de maîtrise qui font leur première session de travail.

• ELG8001

Co-Op Work Term II/Travail coopératif — Iie trimestre

For students in a co-operative master's program who are on their second work term. Pour les candidats à un programme coopératif de maîtrise qui font leur deuxième session de travail.

• ELG9998

Ph.D. Comprehensive Exam/Examen de synthèse du doctorat

For students undergoing the Ph.D. comprehensive examination. Pour les étudiants qui doivent passer l'examen de synthèse du doctorat.

• ELG9999

Ph.D. Thesis/Thèse de doctorat

For students working towards their Ph.D. thesis. Pour les étudiants qui travaillent à leur thèse de doctorat.

The Ottawa-Carleton Institute for Mechanical and Aeronautical Engineering

Mackenzie Bldg. 352
788-5659

The Institute

Director of the Institute: J.Y. Wong

Established in 1983, the institute combines the research strengths and resources of the Departments of Mechanical and Aerospace Engineering at Carleton University and Mechanical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a range of fields of mechanical and aeronautical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the Director of the Institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Mechanical and Aerospace Engineering, Carleton University, and by (O) for the Department of Mechanical Engineering, University of Ottawa.

M. Akben, *Metallurgy* (O)
P.E. Barrington, *Aerodynamics, Aeroelasticity* (C)
R. Bell, *Finite Element Analysis, Stress Analysis, Solid Mechanics* (C)
M.J. Bibby, *Materials and Manufacturing Engineering, Weld Analysis* (C)
S.C. Cheng, *Heat Transfer, Numerical Methods* (O)
M.C. de Malherbe*, *Design, Manufacturing Engineering Processes* (C)
B.S. Dhillon, *Reliability* (O)
Atef Fahim, *CAD/CAM, Controls* (O)
R.C. Flanagan, *Dynamics, Internal Combustion Engines* (O)
K.R. Goheen, *Controls, CAD/CAM/CIM* (C)
J.A. Goldak, *Computer-Integrated Manufacturing Processes, Finite Element Modelling of Manufacturing* (C)
D.J. Gorman, *Vibrations* (O)
D.C. Groeneveld*, *Heat Transfer, Two Phase Flow* (O)
C. Guirao, *Combustion, Gas Dynamics* (O)
Y.M. Haddad, *Applied Mechanics, Finite Element Analysis* (O)
W.L. Hallett, *Fluid Mechanics, Combustion* (O)
G. Kardos, *Design, Fatigue, Fracture Mechanics, CAD, Composite Materials* (C)
R.J. Kind, *Aeronautical Engineering, Industrial Turbomachinery, Wind Engineering* (C)

J. Kirkhope, *Stress and Vibrations, Finite Element Analysis* (C)
A.S. Krausz, *Fracture, Plasticity* (O)
Yung Lee, *Heat Transfer, Nuclear Engineering* (O)
J. Lukaszewicz, *Aerodynamics, Railway Transportation, Impact of Technology on Society* (C)
R.E. Milane, *Combustion* (O)
S. Mirza, *Vibrations, Stress Analysis* (O)
H. Moustapha*, *Turbomachinery, Aerodynamics* (C)
M.B. Munro, *Composite Materials*, (O)
D.S. Neculescu, *Reliability and Control* (O)
E.G. Plett, *Energy Systems, Fluid Mechanics, Thermodynamics and Heat Transfer* (C)
D. Redekop, *Applied Mechanics* (O)
W.G. Richarz, *Aeronautical Engineering, Acoustics, Instrumentation* (C)
J.T. Rogers, *Heat Transfer, Energy Systems, Nuclear Engineering* (C)
M. Salcudean*, *Heat Transfer, Computational Fluid Mechanics* (O)
H.I.H. Saravanamuttoo, *Gas Turbine Performance, Engine Health Monitoring* (C)
J.Z. Sasiadek, *Control Systems, Robotics, Microprocessor Applications* (C)
S.A. Sjolander, *Aerodynamics, Turbomachinery, Wind-Tunnel Engineering* (C)
C.L. Tan, *Solid Mechanics, Boundary Integral and Finite Element Methods* (C)
S. Tavoularis, *Fluid Mechanics, Experimental Techniques* (O)
J.Y. Wong, *Vehicle Engineering, Transportation Technology* (C)

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in mechanical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit is one hour/week for one term (13 weeks). The requirements for the master's

* Adjunct Professor

degree by thesis are:

- 18 course credits
- Participation in the Mechanical and Aeronautical Engineering seminar series, and
- Thesis.

The requirements for the master's degree by α work are: 27 course credits plus a project (Eng. 88.598 for Carleton students; MCG 6000 for University of Ottawa students).

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mechanical or aeronautical engineering or a related discipline. Students who have been admitted to the master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

Program Requirements

The requirements for the Ph.D. degree (from the master's degree) are:

- ~ 18 course credits
- Participation in the Mechanical and Aeronautical Engineering seminar series
- Successful completion of qualifying examinations, and
- Thesis. The examining board for all theses will include professors from both departments and an external examiner who is a member of neither University.

Students who have been permitted to transfer into the Ph.D. program from a master's program require 36 course credits for the Ph.D.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. The available graduate courses are listed below, grouped by subject area. Course descriptions are to be found in the departmental section of the calendar concerned. All courses are of one term duration. Not all courses are necessarily offered during any particular academic year. The following codes identify the department offering the course:

"88" Department of Mechanical and Aerospace Engineering, *Carleton University*

"89" Department of Mechanical Engineering, *University of Ottawa*.

Thermofluids

88.500 (MCG 5300)	Fundamentals of Fluid Dynamics
88.501 (MCG 5301)	Theory of Viscous Flow
88.503 (MCG 5303)	Incompressible Non-Viscous Flow
88.504 (MCG 5304)	Compressible Non-Viscous Flow
88.508 (MCG 5308)	Experimental Methods in Fluid Mechanics
88.509 (MCG 5309)	Environmental Fluid Mechanics Relating to Energy Utilization
88.521 (MCG 5321)	Methods of Energy Conversion
88.522 (MCG 5322)	Safety and Risk Assessment of Nuclear Power
88.530 (MCG 5330)	Acoustics and Noise
88.531 (MCG 5331)	Aero-acoustics
88.532 (MCG 5332)	Instrumentation Techniques
88.543 (MCG 5343)	Advanced Thermodynamics
88.547 (MCG 5347)	Conductive and Radiative Heat Transfer
88.548 (MCG 5348)	Convective Heat and Mass Transfer
88.549 (MCG 5349)	Two-Phase Flow and Heat Transfer
88.570 (MCG 5370)	Special Topics in Mechanical and Aerospace Engineering — Energy Management
89.511 (MCG 5111)	Gas Dynamics
89.531 (MCG 5131)	Heat Transfer by Conduction
89.532 (MCG 5132)	Heat Transfer by Convection
89.533 (MCG 5133)	Heat Transfer by Radiation
89.534 (MCG 5134)	Heat Transfer with Phase Change
89.536 (MCG 5136)	Special Studies in Fluid Mechanics and Heat Transfer
89.541 (MCG 5141)	Statistical Thermodynamics
89.548 (MCG 5551)	Théorie d'écoulement visqueux
89.549 (MCG 5552)	Théorie de turbulence
89.550 (MCG 5557)	Méthodes numériques en mécanique des fluides
89.551 (MCG 5151)	Laminar Flow Theory
89.552 (MCG 5152)	Theory of Turbulence
89.555 (MCG 5155)	Inviscid Flow Theory
89.556 (MCG 5156)	Measurement in Fluid Mechanics
89.557 (MCG 5157)	Computational Fluid Mechanics
89.558 (MCG 5158)	Industrial Fluid Mechanics
89.561 (MCG 5161)	Environmental Engineering
89.566 (MCG 5166)	Nuclear Engineering Fundamentals
89.591 (MCG 5191)	Combustion I
89.592 (MCG 5192)	Combustion II

Solid Mechanics and Materials

- 88.517 (MCG 5317) Experimental Stress Analysis
- 88.550 (MCG 5350) Advanced Vibration Analysis
- 88.561 (MCG 5261) Creative Problem Solving and Design
- 88.562 (MCG 5362) Failure Prevention (Fracture Mechanics and Fatigue)
- 88.563 (MCG 5363) Lightweight Structures
- 88.565 (MCG 5365) Finite Element Analysis I
- 88.566 (MCG 5366) Finite Element Analysis II
- 88.567 (MCG 5367) The Boundary Integral Equation (BIE) Method
- 88.568 (MCG 5368) Advanced Engineering Materials
- 88.570 (MCG 5370) Special Topics in Mechanical and Aerospace Engineering — Introduction to Random Vibrations
- 89.501 (MCG 5101) Theory of Elasticity
- 89.502 (MCG 5102) Advanced Stress Analysis
- 89.503 (MCG 5103) Theory of Perfectly Plastic Solids
- 89.504 (MCG 5104) Theory of Plates and Shells
- 89.505 (MCG 5105) Continuum Mechanics
- 89.507 (MCG 5107) Advanced Dynamics with Applications
- 89.508 (MCG 5108) Finite Element Analysis I
- 89.509 (MCG 5109) Finite Element Analysis II
- 89.510 (MCG 5110) Micromechanics of Solids
- 89.514 (MCG 5114) Analysis and Design of Pressure Vessels
- 89.517 (MCG 5117) Composite Materials I
- 89.518 (MCG 5118) Introduction to Plasticity
- 89.519 (MCG 5119) Introduction to Fracture Mechanics
- 89.525 (MCG 5125) Fatigue of Materials and Structures
- 89.526 (MCG 5126) Deformation of Materials
- 89.529 (MCG 5129) Hot Working of Metals
- 89.537 (MCG 5137) Special Studies in Solid Mechanics and Materials
- 89.580 (MCG 5180) Composite Materials II
- 89.581 (MCG 5181) Advanced Vibrations

Design and Manufacturing

- 88.561 (MCG 5361) Creative Problem Solving and Design
- 88.562 (MCG 5362) Failure Prevention (Fracture Mechanics and Fatigue)
- 88.570 (MCG 5370) Special Topics in Mechanical and Aeronautical Engineering — Robotics and Microprocessor Applications — Control Systems
- 88.574 (MCG 5374) Computer Integrated Manufacturing Systems
- 88.575 (MCG 5375) CAD/CAM
- 89.515 (MCG 5115) Non-linear Optimization

- 89.569 (MCG 5169) Advanced Topics in Reliability Engineering
- 89.570 (MCG 5170) CAD/CAM
- 89.571 (MCG 5171) Applied Reliability Theory
- 89.572 (MCG 5172) Multivariable Digital Control
- 89.576 (MCG 5176) Industrial Control Systems
- 89.577 (MCG 5177) Robot Mechanics
- 89.578 (MCG 5178) Advanced Topics in CAD/CAM
- 89.579 (MCG 5179) Flexible Manufacturing

Transportation Technology

- 88.510 (MCG 5310) Performance and Economics of Aircraft
- 88.511 (MCG 5311) Dynamics and Aerodynamics of Flight
- 88.514 (MCG 5314) Ground Transportation Systems and Vehicles
- 88.521 (MCG 5321) Methods of Energy Conversion
- 88.530 (MCG 5330) Acoustics and Noise
- 88.531 (MCG 5331) Aero-acoustics
- 88.541 (MCG 5341) Turbomachinery
- 88.542 (MCG 5342) Gas Turbines
- 88.598 (MCG 5398) Independent Engineering Study
- 89.500 (MCG 6000) Mechanical Engineering Report

General

- 88.596 (MCG 5395) Directed Studies

In addition, graduate courses offered by departments in other disciplines may be taken for credit with approval by the Department in which the student is registered.

Department of Mechanical and Aerospace Engineering

Mackenzie Bldg. 203
788-5684

The Department

Chairman of the Department:

R.J. Kind

Departmental Supervisor of Graduate Studies:

S.A. Sjolander

The Department of Mechanical and Aerospace Engineering offers programs of study and research leading to M.Eng. degrees in Aeronautical Engineering, Materials Engineering, and Mechanical Engineering, and to Ph.D. degrees in Aeronautical and Mechanical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Mechanical and Aeronautical Engineering, which is jointly administered by the Department of Mechanical and Aerospace Engineering at Carleton University, and the Department of Mechanical Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 113.

Programs of research and study are offered in several areas:

- Aerodynamics and Gas Dynamics
- Heat Transfer
- Stress and Failure Analysis
- Vibration Analysis
- Computer-Aided Design and Engineering
- Robotics
- Vehicle (Performance and Safety) Engineering
- Nuclear Engineering
- Energy Systems
- Energy Conversion and Utilization
- Manufacturing Engineering
- Materials Engineering

The department has a major research commitment, both analytical and experimental, to thermofluid-dynamic and mechanical problems of gas turbine engine design and operation. Current work includes flow prediction and analysis in turbo-machines; two- and three-dimensional boundary layer behaviour; tip-leakage effects and other losses; dynamics of gas turbine power plants; design and performance of highly loaded turbines; engine noise; stress, deformation, and vibration of compressor and turbine blades and discs; finite element analysis; dynamics of high-speed rotors; electron beam welding of refractory metals; failure modes of materials in extreme environments.

Another area of intense research effort in the department is computer-aided engineering. Activities in this field include computer-aided analysis (including

computational gas dynamic methods as well as the finite and boundary element methods), computer-aided design and computer-integrated manufacturing. Projects include thermal and mechanical analysis of welding processes, heat and fluid flow analyses, stress, deformation (manufacturing processes), vibration and fracture mechanics studies and solids modelling. Computer-aided engineering is well supported by computer hardware and software, including a state-of-the-art network of APOLLO workstations. The department has a substantial involvement in the Manufacturing Research Centre of Ontario.

As part of the faculty interest in transportation, the department is active in research on air and ground vehicle technology. Current studies include computational methods for steady and unsteady potential flows over complex configurations; aircraft noise; boundary layer separation and control; propeller and rotor aerodynamics and noise. Research is also conducted on aerodynamic design of wind tunnels for testing of road vehicles. The Transport Technology Research Laboratory has been organized for ground transport studies; design and optimization of off-road vehicles; vehicle safety; anti-lock braking systems; vehicle-terrain interaction; effect of vibration on vehicle performance; dynamics of air-cushion and magnetically levitated vehicles; composite and structural elements.

Members of the department are engaged in research on various aspects of energy conversion, storage and utilization. In addition to the previously mentioned work on gas turbines, research is being undertaken on nuclear energy, coal gasification, effectiveness of energy end-use, air- and water-pollution problems associated with energy utilization and behaviour in wind of energy-conserving cladding systems for buildings. In the nuclear energy field, research is being undertaken in heat transfer and fluid flow aspects of CANDU and SLOWPOKE reactors, with a major effort on thermohydraulic problems in reactor safety. Work is also in progress on reactor safety in general, with a special emphasis on risk. Research activities in this field also include studies on the utilization of CANDU reactors for thermal energy supply as well as electrical generation and on applications of up-rated SLOWPOKE reactors to low-temperature industrial heating and to building energy needs.

Another area of interest is in design, manufacturing and materials technology; in particular, there are programs on the properties of welded joints, heat treatment and forming studies.

The departmental laboratories are well equipped for

the various research activities described above, and these are supported by a machine shop, electronics shop and extensive computing facilities as mentioned earlier.

The extensive laboratory facilities of the National Research Council, and of the Department of Energy, Mines and Resources are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine and nuclear power industries.

Graduate Courses*

Only a selection of the courses listed below is given in a particular academic year.

• Engineering 88.500F1

Fundamentals of Fluid Dynamics

Differential equations of fluid motion. Subsonic flow: potential flow theory; outline of panel methods and flows over wings and bodies. Supersonic flow: oblique shock waves and Prandtl-Meyer expansions; flows over wings and bodies. Viscous flow: the boundary-layer approximation; outline of boundary-layer calculation methods; coupling of viscous and inviscid regions of flow.

S.A. Sjolander.

• Engineering 88.501W1

Theory of Viscous Flows

Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer, and three-dimensional effects.

S.A. Sjolander.

• Engineering 88.503F1

Incompressible Non-Viscous Flow

The fundamental equations and theorems for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory; panel methods.

Miroslav Mokry.

• Engineering 88.504F1

Compressible Non-Viscous Flow

Steady isentropic, frictional, and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory, unsteady, one-dimensional flow.

P.E. Barrington

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Engineering 88.508W1

Experimental Methods in Fluid Mechanics

Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing (subsonic to hypersonic speeds); wind effects on structures; air and water pollution.

W.G. Richarz.

• Engineering 88.509W1

Environmental Fluid Mechanics Relating to Energy Utilization

Characteristics of energy sources and emissions into the environment. The atmosphere: stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modelling of environmental flows.

R.J. Kind.

• Engineering 88.510W1

Performance and Economics of Aircraft

Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance; high lift schemes; operating economics.

D.E. Sattler.

• Engineering 88.511F1

Dynamics and Aerodynamics of Low Speed Flight

Brief review of static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance.

R.J. Kind.

• Engineering 88.514F1

Ground Transportation Systems and Vehicles

Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground-vehicle systems including road vehicles, terrain-vehicle systems, guided transport systems, and advanced ground transport technology.

J.Y. Wong.

• Engineering 88.517W1

Experimental Stress Analysis

Introduction to theory of elasticity. Photo-elasticity: types of polariscopes, two- and three-dimensional stress fields, frozen patterns. Photo-elastic coatings. Strain gauges; gauge factors, sensitivity, calibration, and temperature compensation. Moire fringes, brittle lacquers, mechanical strain gauges.

Robert Bell.

• Engineering 88.521W1

Methods of Energy Conversion

Technical, economic and environmental aspects of present and proposed large-scale systems of energy conversion.

J.T. Rogers.

- Engineering 88.522W1

Safety and Risk Assessment of Nuclear Power

Safety aspects of nuclear power reactors, particularly the CANDU reactor. Principles of nuclear power safety. Probabilistic safety assessment. Analysis of severe accidents. Nuclear power risks in perspective with risks of other electrical energy systems.

J.T. Rogers.

- Engineering 88.530F1

Acoustics

Vibrations of fluids; plane and spherical waves, acoustic pressure and intensity; acoustic impedance: resonators, filters and mufflers; transmission through solid and fluid media; transducers: loudspeakers, microphones; non-linear acoustics.

W.G. Richarz.

- Engineering 88.531W1

Aero-acoustics

The convected wave equation; theory of subsonic and supersonic jet noise; propeller and helicopter noise; fan and compressor noise; boundary layer noise, interior noise; propagation in the atmosphere; sonic boom; impact on environment.

W.G. Richarz.

- Engineering 88.532F1

Instrumentation Techniques

An introduction for the non-specialists to the concepts of digital and analog electronics with emphasis on data acquisition, processing and analysis. Topics covered include operational amplifiers, signal processing, digital logic systems, computer interfacing, noise in electronic systems. 'Hands on' sessions illustrate theory and practice.

W.G. Richarz.

- Engineering 88.541F1

Turbomachinery

This course deals with the generalized performance of turbomachinery, and with the thermo- and aerodynamic design of axial and radial flow machines. The emphasis is on compressible flow machines.

S.H. Moustapha.

- Engineering 88.542W1

Gas Turbines

Interrelationship among thermodynamic, aerodynamic, and mechanical design. Ideal and real cycle calculations. Cycle optimization; turboshaft, turbojet, turbofan. Component performance. Off-design performance; matching of compressor, turbine, nozzle. Twin-spool matching.

H.I.H. Saravanamuttoo.

- Engineering 88.543W1

Advanced Thermodynamics

The course covers three major topics: review of fundamentals from a consistent viewpoint, properties and equations of state, and applications and special topics. The third topic includes an introduction to statistical thermodynamics.

E.G. Plett.

- Engineering 88.547W1

Conductive and Radiative Heat Transfer

Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, gray, non-gray diffusive and specular surfaces, including effects of athermanous media.

E.G. Plett.

- Engineering 88.548W1

Convective Heat and Mass Transfer

Review of analogies between heat, mass and momentum transfer. Free and forced convection from theoretical and experimental viewpoint for laminar and turbulent flows in ducts and over flat plates and blunt bodies. Heat transfer-friction relationship in heat exchangers. Film and dropwise condensation. Boiling with forced and natural convection. Two-phase flow. Mass transfer in stationary, laminar and turbulent flow systems.

E.G. Plett.

- Engineering 88.549F1

Two-Phase Flow and Heat Transfer

Topics covered include basic equations of liquid-vapor and liquid-gas flows including choked flows and flow oscillations, heat transfer rates and critical heat fluxes. Applications to practical problems are emphasized.

J.T. Rogers.

- Engineering 88.550W1

Advanced Vibration Analysis

General theory of discrete, multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aeronautical, civil, and mechanical engineering.

James Kirkhope.

- Engineering 88.561W1

Creative Problem Solving and Design

This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty.

Geza Kardos.

- Engineering 88.562F1

Failure Prevention (Fracture Mechanics and Fatigue)

The course deals with the design of engineering structures to ensure against failure due to fatigue or brittle fracture. It emphasizes an understanding of the nature of fatigue and brittle fracture, and thereby the selection of suitable material, geometry, and inspection procedures for the load and environmental condition intended.

Geza Kardos.

- Engineering 88.563W1

Lightweight Structures

Structural behaviour. Stresses and shear flows in single stroke multicell structures. Bending, twisting of thin-walled beams. Bending of plates. Thin membrane shell structures. Energy principles. Air supported structures. Aeroelastic problems in aircraft supported structures. Matrix methods and modal analysis in lightweight structures. T.B.A.

- Engineering 88.565F1

Finite Element Analysis I

An introduction to the finite element methodology, with emphasis on applications to heat transfer, fluid flow and stress analysis. The basic concepts of Galerkin's method, interpolation, numerical integration, and isoparametric elements are taught using simple examples.

J.A. Goldak.

- Engineering 88.566W1

Finite Element Analysis II

Time marching heat flow problems with linear and nonlinear analysis. Static plasticity. Time-dependent deformation problems; viscoplasticity, viscoelasticity, and dynamic analysis. Isoparametric elements and numerical integration are used throughout.

J.A. Goldak.

- Engineering 88.567F1

The Boundary Integral Equation (BIE) Method

Introduction to integral equation. Potential theory: Dirichlet and Neumann problems in engineering practice. Two-dimensional BIE for harmonic problems. Constant line elements. Numerical treatment of BIE. Two-dimensional BIE for elastostatics. Isoparametric line elements. Numerical treatment of BIE and integration schemes. Use of BIE computer programs for solving problems in elastostatics and potential theory.

C.L. Tan.

- Engineering 88.568F1

Advanced Engineering Materials

This course presents an overview of the mechanical properties of engineering material as a basis for materials selection and design in computer-integrated manufacturing. The first part of the course considers the phenomenological aspects of strength, fracture, fatigue and corrosion/wear, test methods, material properties and use of databases. The second part covers the structure and deformation/fracture mechanisms of the engineering materials: metals and alloys, ceramics, polymers, rapidly-solidified alloys, surface-modified materials, cellular solids, composite materials.

Precludes additional credit for Engineering 88.468

Prerequisite: Engineering 88.270 or 88.271.

Not offered 1989/90.

- Engineering 88.570T1

Special Topics in Mechanical and Aerospace Engineering

Courses in special topics related to mechanical engineering and aerospace engineering, not covered by other graduate courses; course details will be available prior to registration.

Topics for 1989-90

- Optimal Control Systems

Review of transfer function and state space system descriptions. Elements of the optimal control problem. Variational calculus. Optimal state feedback control. Riccati equations. Optimal observers and Kalman-Bucy filters. Extension to discrete time systems including an introduction to Dynamic Programming. Practical applications are emphasised throughout the course. K.R. Goheen.

- Introduction to Random Vibrations

Basic statistical concepts; single degree of freedom systems; characterization of systems by their response functions; analysis in the frequency domain; example applications to current mechanical and aerospace engineering problems.

B.V. Tryggvason.

- Energy Management

This course is aimed at persons potentially responsible for recommendations regarding energy and fuels planning, purchase and utilization and for design and financial analysis of energy systems. Topics include oil, gas, coal, biomass, nuclear energy and electricity; pipeline regulation and pricing policy; energy availability, utilization, distribution and conservation; implementation methods and profitability analysis of energy projects.

G.A. Robb.

- Robotics and Microprocessors Application

The history and an introduction to robotics methodology. Robots and manipulators; homogeneous transformations, kinematic equations, solving kinematic equations, differential relationships, motion trajectories, dynamics. Control; feedback control, compliance, servomotors, actuators, external and internal sensors, grippers and vision systems. Microprocessors and their application to robot control. Programming.

T.B.A.

- Engineering 88.574W1

Computer-Integrated Manufacturing Systems (CIMS)

This course presents an overview of the topics essential to CIMS. These include computer graphics, geometric modelling, kinematic analysis, numerically controlled machining, robotics, and flexible manufacturing systems, with the objective of understanding the fundamental data structures and procedures that are appropriate to the computerization of engineering design, analysis and production.

Precludes credit for Engineering 88.474

J.A. Goldak.

- Engineering 88.575F1

CAD/CAM

Fundamentals of computer aided design (CAD): review of the design process, elements of computer graphics including hardware and software standards. Wire frames, boundary representations, constructive solids geometry, sculptured surfaces. Data bases. Graphics and product interchange files. Fundamentals of computer aided manufacturing (CAM): numerical control (NC), CNC, DNC, adaptive control. CAM programming. Introduction to popular commercial CAD programs. Management issues including acquisition, training and security.

Precludes credit for Engineering 88.475.

Text: Hearn and Baker 'Computer Graphics'

K.R. Goheen.

- Engineering 88.596F1, W1, S1

Directed Studies

- Engineering 88.598F3, W3, S3

Independent Engineering Study

In this course, the student pursuing a master's degree by course work will carry out an independent study, analysis, and solution of an engineering problem or design project. The results will be given in the form of a written report and may be presented at a departmental seminar. The study will be carried out under the general direction of a faculty member.

- Engineering 88.599F4, W4, S4

M.Eng. Thesis

- Engineering 88.699F, W, S

Ph.D. Thesis

Other Courses of Particular Interest

Civil Engineering

- 82.511 Introductory Elasticity
- 82.512 Advanced Elasticity
- 82.513 Finite Element Methods in Stress Analysis
- 82.524 Behaviour of Steel Structures
- 82.534 Intercity Transportation, Planning and Management

Systems and Computer Engineering

- 94.501 Simulation and Modelling
- 94.504 Computer Methods in Industrial Engineering
- 94.505 Optimization Theory and Methods
- 94.552 Advanced Linear Systems
- 94.553 Stochastic Processes

Physics

- 75.447 Statistical Physics
- 75.511 Classical Mechanics and Theory of Fields

Mathematics and Statistics

- 70.486 Numerical Analysis
- 70.586 Numerical Analysis

School of Architecture

Architecture Bldg. 202

788-2855

The School

Director of the School: Gilbert F. Sutton

The School of Architecture does not offer a program at the graduate level. However, it does offer graduate-level courses which can be used towards a degree program in the Faculty of Engineering, the Institute of Canadian Studies, and the Faculty of Social Sciences at Carleton. There is also an understanding with the Faculty of Environmental Studies at York University, the Centre for Building Studies at Concordia University, and the Faculté de l'Aménagement at the Université de Montréal, that a student registered in their program can apply for permission to do a certain part of the graduate work through course offerings made at the Carleton School of Architecture. Members of the school also supervise graduate research.

The interests and capabilities of the faculty members lie in the following areas:

History and Theory of Architecture

Scholarly studies in architectural thought from renaissance to modern movement, current debate and contemporary issues; Canadian architecture; Mayan architecture; Islamic architecture.

Architecture and Society

Ethnicity, multiculturalism and architectural expression; international development and indigenous architecture; heritage and preservation; evolution of the architecture profession.

Architecture and Technology

Building envelope and construction details; design economics; structures; energy; lighting; acoustics; integration of systems.

Architecture and the City

Urban morphologies, architectural content of urban planning and design; social, cultural, economic and political matrix in the urban society and the contemporary architectural reality.

Computer-Aided Design and Management

Design modelling, visual communication, computer graphics; computers and architectural practice.

Architecture and Morphology

Studies in form, space, structure and order; geometric and symbolic orders in architecture.

Graduate Courses*

- Architecture 76.500F1, W1
Directed Studies in History and Theory of Architecture
Reading and research tutorials.
- Architecture 76.501F1, W1
Directed Studies in Architecture and Society
Reading and research tutorials.
- Architecture 77.500F1, W1
Directed Studies in Architecture and Technology
Reading and research tutorials.
- Architecture 78.500F1, W1
Directed Studies in Architecture and the City
Reading and research tutorials.
- Architecture 79.500F1, W1
Directed Studies in Computer-Aided Design
Reading and research tutorials.
- Architecture 79.501F1, W1
Directed Studies in Architecture and Morphology
Reading and research tutorials.

An honours degree or equivalent qualification in a relevant field, as well as permission of the school, is a requirement for admission to these courses.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

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Departmental

Program

Descriptions

and

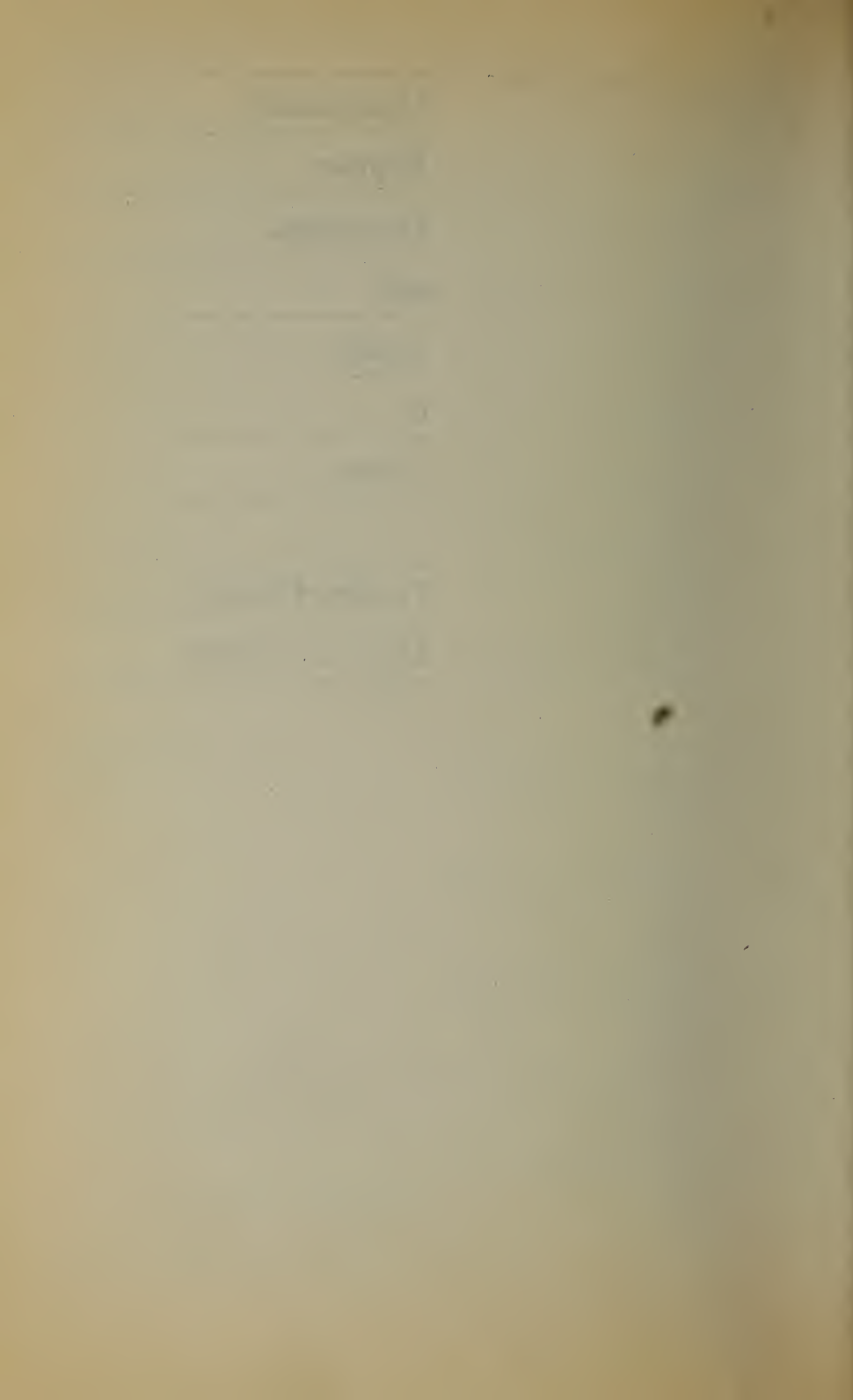
Details

of

Courses

Faculty of Science

Dean: L.A. Copley



Ottawa-Carleton Institute of Biology

Tory Bldg. 583

788-3859

The Institute

Director of the Institute: H.G. Merriam

Associate Director: J.T. Arnason

Students wishing to pursue studies in biological sciences at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Biology of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the centre. Additional criteria for admission include academic performance, research experience, and referees' appraisals. The student must also be accepted by a faculty member who will supervise the research project, and the choice of supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

Requests for information, and completed applications should be sent to the director of the institute, or to the supervisor of graduate studies at either institution.

Members of the Institute

J.B. Armstrong, *Developmental Biology*
 J.T. Arnason, *Biochemical Ecology*
 C.A. Barlow, *Experimental Ecology*
 Linda Bonen, *Molecular Biology*
 I.M. Brodo, *Lichen Systematics*
 D.C.W. Brown, *Plant Genetic Engineering*
 D.L. Brown, *Cell Biology*
 M. Canny, *Whole Plant Physiology*
 G.R. Carmody, *Population Genetics*
 Nathalie Chaly, *Nuclear Cytology*
 Yves Cloutier, *Cold Physiology of Plants*
 D.J. Currie, *Population Ecology*
 H. Damman, *Insect Behavioural Ecology*
 J.R. Dillon, *Molecular Genetics*
 J.C. Fenwick, *Comparative Endocrinology*
 S. Findlay, *Evolution*
 R.G. Fulcher, *Cereal Grain Biochemistry*
 D.R. Gardner, *Pesticide/Nerve Interactions*
 A.J. Gaston, *Conservation Biology*
 Roy Greenhalgh, *Environmental Toxicology*
 D.A. Hickey, *Population Genetics*
 J. Houseman, *Insect Physiology*
 H.F. Howden, *Biogeography, Systematics of Insects*
 V.N. Iyer, *Bacterial Genetics*
 S.L. Jacobson, *Excitable Cell Physiology*
 D.A. Johnson, *Molecular Biology*
 K.W. Joy, *Plant Metabolism*

P.A. Keddy, *Plant Ecology*
 W.A. Keller, *Plant Tissue Culture*
 S.U. Khan, *Pesticide Ecological Chemistry*
 D.J. Kushner, *Microbiology*
 J.D.H. Lambert, *Plant Communities and Man*
 P.E. Lee, *Viral Ultrastructure*
 L.R. Lefkovich, *Mathematical Biology*
 D.E. McAllister, *Fish Systematics*
 M.W. McBurney, *Developmental Biology*
 M.E. McCully, *Plant Ultrastructure and Development*
 J. McNeill, *Plant Systematics*
 Lubomir Masner, *Hymenoptera Systematics*
 H.G. Merriam, *Woodland Ecosystems*
 B.L.A. Miki, *Plant Molecular Genetics*
 T.W. Moon, *Comparative Physiology*
 A. Morin, *Community Ecology*
 C.E. Morris, *Physiology of Excitable Cells*
 S.A. Narang, *Molecular Biology*
 Anwar Nasim, *Eukaryote Molecular Genetics*
 J.M. Neelin, *Nuclear Proteins and Differentiation*
 Constance Nozzolillo, *Plant Physiology, Phytochemistry*
 M. Paulin-Levasseur, *Cell Biology*
 D.D. Peakall, *Wildlife Toxicology*
 S.B. Peck, *Arthropod and Beetle Evolution Systematics*
 S.F. Perry, *Comparative Respiratory Physiology*
 B.J.R. Philogène, *Ecophysiology of Insects*
 F. Pick, *Microbial Physiology and Ecology*
 Jaroslav Picman, *Behavioural Ecology*
 S.U. Qadri, *Ichthyology*
 G.P. Raaphorst, *Cellular Repair*
 J.N. Saddler, *Cellulolytic Microbiology*
 V.L. Seligy, *Molecular Genetics*
 John Sinclair, *Biophysics of Cells*
 D.G. Sprott, *Bacterial Physiology*
 K.B. Storey, *Biochemical Adaptations*
 Jean Vaillancourt, *Animal Ecology*
 S.I. Warwick, *Plant Systematics*
 P.J. Weatherhead, *Behavioural Ecology*
 J.A. Webb, *Plant Metabolism*
 Pearl Weinberger, *Environmental Plant Physiology, Ecotoxicology*
 Frank Wightman, *Metabolism of Plant Hormones*
 D.M. Wood, *Insect Systematics*
 R.C. Wyndham, *Applied Microbiology and Ecology*
 Hiroshi Yamazaki, *Bacterial Metabolism, Biotechnology*

Ottawa-Carleton Graduate Specialization in Neuroscience

The Departments of Biology and Psychology at Carleton University, and the Departments of Anatomy, Physiology, and Psychology at the University of Ottawa provide a graduate specialization in neuroscience at the M.Sc. and Ph.D. level. For further details see page 203.

Each campus is well equipped for a wide range of biological research; some major equipment and facilities include transmission and scanning electron microscopes, spectrophotometers, liquid scintillation and other radioactivity counters, high performance liquid and gas chromatographs, amino acid analyzer, preparative and analytical ultracentrifuges, electrophysiology equipment, animal and plant growth facilities, controlled environment cabinets, and on-line computer access. Students also benefit from the resources of nearby government laboratories and libraries (for example, Agriculture Canada, Environment Canada, Health and Welfare Canada, and the National Research Council).

Master of Science

Admission Requirements

An honours B.Sc. or equivalent degree at a standard acceptable to the two universities is required for admission to the M.Sc. program. Applicants with acceptable standing in a non-honours degree may be admitted to a qualifying-year program which will be determined in each case by the admissions committee.

Applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements

The M.Sc. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the advanced courses specified by the admissions committee and the student's advisory committee; these will range from one to three full (two-term) courses, depending on the background and research program of the student. At least one course at the graduate level must be included, and not more than one course at the fourth-year honours level (completed while registered as a graduate student) may form part of the candidate's course requirements. The passing grade for all required courses is 70% or equivalent, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.

- Completion of at least two terms as a full-time student resident at one of the two universities is normally required. Programs for part-time students may be arranged.

- Presentation of one public seminar on the candidate's thesis research.

- Completion of a thesis incorporating the results or original research carried out under the direct supervision of an approved faculty member.

- Successful oral defence of the thesis before an examination board of at least three faculty members, normally drawn from both universities.

Doctor of Philosophy

Admission Requirements

An M.Sc. from a recognized university is usually required for entry to the Ph.D. program; however, an applicant with a first-class B.Sc. and excellent references may be admitted directly to the Ph.D. program. A student already registered for the M.Sc. may be permitted to transfer to the Ph.D. program following a recommendation by the departmental graduate committee and successful completion of the comprehensive examination required of Ph.D. candidates.

All applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements

The Ph.D. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the courses at the graduate level specified by the admissions and advisory committees; these will range from two to four full courses (three to six courses if admitted without an M.Sc.), depending on the background and research program of the student. Only graduate courses may form part of the candidate's course requirements. The passing grade for all required courses is 70%, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.

- Completion of an oral comprehensive examination within approximately 12 months of entry into the program; this examination will cover the candidate's area of research, and general biology. The format of the examination will be established by the departmental graduate committee and approved by the admissions committee. The examination committee will generally be composed of faculty members of both universities.

- Presentation of at least one public seminar on the candidate's thesis research.

- A thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member.
- Completion of at least four terms as a full-time student resident at one of the two universities (or six terms if admitted without an M.Sc.) is normally required. Under exceptional conditions programs may be arranged for part-time students.
- Successful oral defence of the thesis before an examination board of at least five faculty members, with representation from both universities, and including an external examiner from outside the two universities who is an authority on the thesis research area.

Graduate Courses*

The following courses are offered in the graduate program, but not all are available in any academic year. A list of the courses scheduled for the year is available from the centre in May.

- **Biology 61.501F1 (BIO5101)**

Topics in Biotechnology

A course concerned with the utilization of biological substances and activities of cells, genes and enzymes in manufacturing, agricultural and service industries. A different topic will be selected each year.

Prerequisite: A course in cell physiology or biochemistry, or permission of instructor.

Hiroshi Yamazaki.

- **Biology 61.502F1 (BIO8300)**

Applied and Industrial Microbiology

A lecture and reading course on the use of micro-organisms in industrial processes. Subjects to be covered will include microbial fermentations, enzymology, secondary metabolites, biomass and fuel production.

D.J. Kushner, J.N. Saddler and others.

- **Biology 61.503F1 (BIO5103)**

Comparative Biochemistry

Advanced topics emphasizing biochemical structures, functions and methodologies in the context of animal (invertebrates and vertebrates) adaptations to environmental stress.

T.W. Moon and K.B. Storey.

- **Biology 61.510W1 (BIO5301)**

Plant Development

An advanced course dealing with selected topics in the experimental study of plant development.

M.E. McCully.

- **Biology 61.517T2 (BIO5202)**

Molecular Genetics

Development and use of genetic methods in the solution of problems in molecular biology, including discussion of innovations and current efforts of *in vivo* and *in vitro* genetic engineering. Lectures, seminars, laboratory, essays.

Prerequisites: Graduate standing and permission of the department.

V.N. Iyer.

- **Biology 61.518F1 (BIO8171)**

Techniques in Genetic Engineering

An advanced laboratory course on recombinant DNA techniques including molecular cloning, electrophoretic and hybridization analysis, DNA sequencing and computer analysis, and protein characterization. Seminar presentations/reports on practical applications of these techniques will also be required. Enrolment is limited and permission of the instructor is required.

L. Bonen and D. Hickey.

- **Biology 61.519T2 (BIO8219)**

Evolutionary Genetics

A lecture/seminar course on the genetic mechanisms responsible for variation and evolutionary change in natural populations. The course will consider both ecological and molecular questions from an evolutionary perspective. Topics will include protein and genome evolution; evolutionary significance of regulatory and structural gene variation; concepts of individual, deme and group selection; relationships of microevolution to macro-evolutionary trends; selfish DNA.

Prerequisites: Graduate standing plus basic course in genetics and evolution; permission of the department.

G.R. Carmody, L. Bonen and D.A. Hickey.

- **Biology 61.520T2 (BIO8238)**

Techniques of Microscopy

An advanced laboratory course in the principles and techniques of light microscopy and electron microscopy.

Prerequisite: Open to fourth year and graduate students with permission of the instructor.

D.L. Brown.

- **Biology 61.525T2 (BIO5204)**

Plant Physiology and Metabolism

An advanced course dealing with selected topics in plant physiology and plant metabolism.

Prerequisite: Graduate standing or permission of the department.

- **Biology 61.534T2 (PSY6201)**

Basics of Neuroscience

A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology.

(Also offered as Psychology 49.520T2)

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Biology 61.535T2 (BIO5212)

Special Studies in Physiology

Advances in cellular neurophysiology. Two lectures per week, four hour laboratory and essay assignment. D.R. Gardner.

• Biology 61.536T2 (BIO9201)

Photobiology

A course dealing with the interaction between light and living organisms, including an introduction to photochemistry, and a detailed study of photosynthesis, vision, photosensitivity, and photoperiodism.

Prerequisite: An advanced course in animal or plant physiology or biochemistry, or permission of the department.

John Sinclair, J.T. Arnason and B.J.R. Philogène.

• Biology 61.537F1 (BIO8122)

Advanced Insect Physiology

Physiological characteristics of insects. In addition to the course material, students will write two term papers.

J. Houseman.

• Biology 61.542T2 (BIO8162)

Developmental Endocrinology/Topics in Comparative Endocrinology

A lecture and reading course concerned with classical as well as current topics in the field of comparative endocrinology. Special emphasis will be placed on the vertebrates. Offered in alternate years.

Prerequisite: BIO4113 or permission of the instructor. J.C. Fenwick.

• Biology 61.545T2 (BIO9202)

Project in Applied Ecology

A course in the form of a special research project in which the student identifies an environmental problem and the corporate or governmental body that has the power to rectify the problem. Work includes: 1) a literature review with a report on this review; 2) a second report, in the form of an article in a newspaper or magazine, to convey the relevant results to non-scientists; 3) an approach to the relevant private or governmental agency with an attempt to have the solution implemented and a detailed report on this experience. (Enrolment limited.)

P. Keddy.

• Biology 61.546F1 (BIO9303)

Advanced Plant Ecology

Plant population biology, and its usefulness in explaining attributes of plant communities, will be discussed in weekly seminars based on assigned readings. During the labs projects will be carried out to clarify topics such as vegetation classification and competition.

P. Keddy.

• Biology 61.547T2 (BIO5205)

Quantitative Ecology

A lecture and laboratory course on concepts and analysis of the distribution and abundance of plants and animals, and of related environmental phenomena. Two analytical or critical essays on an ecological topic will be required.

Prerequisites: Graduate standing, courses in elementary ecology and statistics and permission of the department.

C.A. Barlow.

• Biology 61.548T2 (BIO9200)

Advanced Community and Population Ecology

Lectures and seminars on recent experimental approaches, concepts and findings in population and community ecology.

D.J. Currie, P.A. Keddy and H.G. Merriam.

• Biology 61.549T2 (BIO5206)

Mathematical Modelling for Biologists

This course is designed to develop mathematical tools for the modelling of biological processes. The student is taught the necessary mathematics, a computer language, and guidance is given in the choice of simulation of a biological process.

L.P. Lefkovich.

• Biology 61.550T2 (BIO5207)

Selected Topics

Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

• Biology 61.551F1 (BIO8104)

Selected Topics in Biology I

Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

• Biology 61.552W1/S1 (BIO8102)

Selected Topics in Biology II

Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

• Biology 61.553T2 (BIO5901)

Recent Advances in Biology

A course intended for all first-year graduate students to bring them up to date in the various major areas of biology. The course will consist of selected readings, lectures and invited speakers.

• Biology 61.556T2 (BIO5213)

Advanced Insect/Animal Systematics

A lecture and seminar course concerning methods, roles and advances in systematics of insects and other animals. One research project required.

Prerequisite: 400-level course in identification or classification of insects or other animals.

H.F. Howden.

• Biology 61.565F1, W1, S1 (BIO5102)

Field Course

Credit for this half-course is based on a total of three weeks of field-course modules, involving one or two weeks of intensive and continuous field work with attendant assignments. For details, see co-ordinator.

Co-ordinator: P.J. Weatherhead.

• Biology 61.570T2 (BIO5209)

Evolution and Biogeography

A lecture course in biogeography and evolution requiring a graduate level literature project.

Prerequisite: Graduate standing and permission of the department.

H.F. Howden.

• Biology 61.581F1 (BIO5105)

Animal Behaviour

A half-credit course in animal behaviour from an ecological and evolutionary point of view with additional independent assignments.

Prerequisites: Biology 61.335* and 61.361* or equivalents and registration in a graduate program, or written permission of the department.

P.J. Weatherhead.

• Biology 61.582F1 (BIO8365)

Advanced Studies in Behavioural Ecology

Recent ideas and research on advanced topics dealing with the evolution of foraging, temporal, spatial, and reproductive strategies will be discussed and critically examined. Each student will be required to give two seminars (one in Fall, one in Winter), write two term papers on selected topics, and all students will participate in discussions of controversial problems.

J. Picman.

• Biology 61.599F, W, S

M.Sc. Thesis

• Biology 61.601F1 (BIO8109)

Advanced Molecular Biology I

Recent advances in molecular biology. Topics for discussion may include the following: DNA structure and function, the organization of the genome; DNA, RNA and protein synthesis; the regulation of gene expression in eucaryotes and procaryotes. Topics will reflect the interests of the teaching staff. Biology 61.602W1 (BIO8217) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

• Biology 61.602W1 (BIO8116)

Advanced Molecular Biology II

Recent advances in molecular biology. Topics for discussion may include the following: mutagenesis and DNA repair mechanisms; molecular aspects of gene transfer recombination and gene arrangement; gene transfer mechanisms, the molecular biology of yeasts and fungi, especially with regard to industrial applications; the modern techniques of genetic engineering as

applied to industrial and medical problems. Topics will reflect the interests of the teaching staff. Biology 61.601F1 (BIO8209) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

• Biology 61.621F1 (BIO8117)

Advanced Cell Biology I

Recent advances in cell biology. Topics for discussion may include the following: the composition, biosynthesis and three-dimensional organization of the cytoskeleton, factors regulating its deployment and the role of cytoskeletal elements in mitosis, cell-substrate attachment, cell motility, transport of organelles and axoplasmic transport, cell surface and extracellular matrix. Topics will reflect the interests of the teaching staff. Biology 61.622W1 (BIO8118) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

• Biology 61.622W1 (BIO8118)

Advanced Cell Biology II

Topics for discussion may include the following: the structure, composition and three-dimensional organization of the nucleus, mechanisms and regulation of genome replication, structural organization of transcription. Role of the nucleus in virus replication and hormone response, structural and functional reorganization of nuclear components during gamete development, fertilization and the mitotic cell cycle. Topics will reflect the interests of the teaching staff. Biology 61.621F1 (BIO8117) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

• Biology 61.623F1 (ANA7400 Fall Term)

Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department.

(Also offered in Psychology as 49.624F1)

• Biology 61.624W1 (ANA7400 Winter Term)

Neuroscience Techniques II

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department. The supervisor must be different from that of 61.623F1.

(Also offered as Psychology 49.625W1)

• Biology 61.625T2 (BIO8119)

Advanced Plant Physiology

A lecture and seminar course dealing with selected topics in advanced plant physiology, available only to graduate students.

Prerequisite: Biology 61.429 or equivalent, or permission of the department.

- Biology 61.627F1 (BIO8164)

Ion Channels

A lecture and seminar course on the physiological and biophysical characteristics of ion channels. Topics will be selected from such areas as: determinants of channels selectivity, conformation changes, chemically-induced and voltage-induced gating, models of excitability, methods of studying channels (single channel studies, gating currents, pharmacological tools), and cellular distribution, modulation and development of channels. Offered in alternate years.

- Biology 61.630T2 (BIO8220)

Advanced Plant Biochemistry

A lecture and seminar course, available only to graduate students, and dealing with selected topics in advanced plant biochemistry.

Prerequisites: Biology 61.425 and Biology 61.426/427, or permission of the department.

- Biology 61.631W1 (BIO8121)

Advanced Microbial Physiology

Physiological function of micro-organisms in relation to microscopic and molecular structure; differentiation and regulation; mode of action of antibiotics and toxic substances. Lectures and advanced reading.

- Biology 61.633T2

Advanced Seminar in Neuroscience

An advanced seminar course integrating various aspects of neuroscience.

(Also offered as Psychology 49.620T2)

Prerequisite: Psychology 49.520 or 49.623

- Biology 61.634F1 (BIO8361)

Advanced Topics in Animal Physiology

In-depth study of areas in animal physiology of current research interest.

J.C. Fenwick, S.F. Perry and T.W. Moon.

- Biology 61.638F1 (BIO8363)

Evolution and Adaptation in Fish

Consideration of evolution and adaptation with emphasis on concepts and ideas. Evolution of certain organ systems and phylogenetic groups. Adaptations to specific habitats. Lectures and seminars.

D.E. McAllister.

- Biology 61.641F1 (BIO8135)

Topics in Plant Biology

Special topics of current interest.

- Biology 61.642F1 (BIO9101)

Environmental Toxicology

Selected topics and advances in environmental toxicology with emphasis on the biological effects of contaminants. The course will be taught in a seminar format with presentations by members of the staff and invited speakers. Offered in alternate years.

- Biology 61.643F1 (BIO9104)

Ecotoxicology: Agricultural Implications

A wide array of pollutants, both gaseous and liquid, are reaching recreational and agricultural lands and aquatic watercourses. Some insights will be given into the potential for biotic perturbation which may result from chronic and acute exposure to selected toxicants. Methods of pesticide and herbicide residue analysis and concepts of bound residues will also be examined. Offered in alternate years or as registration warrants; minimum of eight students.

Pearl Weinberger, Roy Greenhalgh, S.U. Khan, B.J.R. Philogène, S.U. Qadri and guest lecturers.

- Biology 61.644F1 (BIO8436)

Plant: Animal Interactions

Secondary metabolites of plants and their role as attractants or antifeedants to animals and as allelopathic or antifungal agents. Emphasis will be placed on co-evolution of plants and phytophagous organisms such as insects and mammals, and the ecological and physiological dimensions of this relationship. Offered in alternate years.

J.T. Arnason, B.J.R. Philogène, Constance Nozzolillo, J. Houseman.

- Biology 61.645W1 (BIO9105)

Topics in Toxicology

This will be a lecture/seminar course which will cover such topics as hazard assessment, requirements for registration, biodegradation, transfer mechanisms and physiological and biochemical responses induced by herbicides and pesticides. Pesticides of natural origin will also be discussed.

T. Arnason and P. Weinberger.

- Biology 61.660T2 (BIO8242)

Special Ichthyology I

Morphology, systematics and life histories of cyclostomes, elasmobranchs and the soft-rayed teleosts.

S.U. Qadri.

- Biology 61.661T2 (BIO8243)

Special Ichthyology II

Morphology, systematics and life histories of the perciform fish.

S.U. Qadri.

- Biology 61.680T2 (BIO8221)

Advanced Studies in Animal Behaviour

A seminar and laboratory course dealing with current topics in the study of animal behaviour. Students will be expected to present seminars based on the recent literature, and to conduct a research project on some aspect of animal behaviour.

Prerequisites: Biology 61.581 or equivalent, or permission of the department.

P.J. Weatherhead.

- Biology 61.699F, W, S

Ph.D. Thesis

The Ottawa-Carleton Chemistry Institute

Steacie Bldg. 218
788-3841

The Institute

Director of the Institute: J.S. Wright

Associate Director of the Institute: M.H. Back

The Ottawa-Carleton Chemistry Institute, established in 1981, is a joint program of graduate studies and research in chemistry for Carleton University and the University of Ottawa. The Institute combines the research strengths and resources of the Departments of Chemistry at both campuses. Research facilities are shared and include: a major Mass Spectrometry Centre, several modern NMR spectrometers, a pico-second laser facility, an ultratrace analysis laboratory, and an electrochemical research centre. In addition, the resources of many federal departments are available to graduate students, including the National Research Council and its library, the National Science Library (CISTI), and departments of Health and Welfare and Agriculture.

The Institute offers the M.Sc. and Ph.D. degrees in all areas of chemistry, including analytical, biochemistry, inorganic, organic, physical and theoretical chemistry. All thesis, seminar and examination requirements may be met in either English or French. Students will be enrolled at the campus where the research supervisor is located. Several graduate students also conduct their research off-campus under the supervision of one of the Institute Adjunct Professors. Application forms and further information can be obtained by writing to the Director of the Institute.

Members of the Institute

Howard Alper, *Organometallic Chemistry*
J.W. ApSimon, *Natural Products Chemistry*
M.H. Back, *Chemical Kinetics and Photochemistry*
H.H. Baer, *Carbohydrate Chemistry*
R.G. Barradas, *Electrochemistry*
A.D.O. Bawagan, *Chemical Physics*
D.M. Bishop, *Theoretical Chemistry*
G.W. Buchanan, *Applications of NMR Spectroscopy*
P.H. Buist, *Bio-organic Chemistry*
C.L. Chakrabarti, *Analytical Chemistry*
B.E. Conway, *Electrochemistry*
R.J. Crutchley, *Physical Inorganic Chemistry*
Christian Detellier, *Bio-inorganic Chemistry*
Tony Durst, *Synthetic and Medicinal Organic Chemistry*
A.G. Fallis, *Natural Products Chemistry*
R.R. Fraser, *Physical Organic Chemistry*
I. Hamilton, *Theoretical Chemistry*
B.R. Hollebone, *Chemical Spectroscopy and Chemical Toxicology*

J.L. Holmes, *Mass Spectroscopy*

J.A. Koningstein, *Chemical Physics*

Peeter Kruus, *Solution Physical Chemistry, Ultrasonics*

E.P.C. Lai, *Photoacoustic Spectroscopy, Analytical Chemistry*

K.J. Laidler*, *Reaction Kinetics*

J.B. Milne, *Inorganic Chemistry*

Peter Morand, *Organic Chemistry*

B.A. Morrow, *Surface Chemistry and Catalysis*

J.A. Ripmeester**, *Colloid and Clathrate Chemistry*

J.-L.A. Roustan, *Bio-inorganic Chemistry*

R. Roy, *Organic Chemistry*

J.C. Scaiano**, *Photochemistry*

I.C.P. Smith**, *NMR Studies of Biologically Important Molecules*

Heshel Teitelbaum, *Gas Phase Reactions*

C.S. Tsai, *Biochemistry of Enzymes and Yeast Cultures*

A.D. Westland, *Physical Inorganic Chemistry*

D.C. Wigfield, *Chemical Toxicology*

C.P. Wilde, *Electrochemistry*

D.R. Wiles, *Radio-analytical Chemistry*

J.S. Wright, *Theoretical Chemistry*

* Professor Emeritus

** Adjunct Professor

Master of Science

Admission Requirements

The normal requirement for admission to the program is an honours B.Sc. degree in Chemistry, with a B+ average in the last two years and a B average overall. Applicants who do not meet this requirement, or whose undergraduate degree is in another, closely related field, may be accepted into the program, but may be assigned extra courses.

Program Requirements

- A research thesis, which must be defended at an oral examination
- Two graduate courses (one semester each)
- One seminar course (two semesters)

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a B.Sc. or an M.Sc. degree in Chemistry.

Program Requirements (from B.Sc.)

- A research thesis, to be defended before an examination board which will include an external examiner

- A comprehensive examination in chemistry; the format of this examination depends on the field of chemistry in which the student is conducting his/her research. At Carleton this normally takes the form of a research proposal.

- Seven graduate courses (one semester each)
- Two seminar courses (two semesters each)

Program Requirements (from M.Sc.)

- As above, except that credit for up to two graduate courses may be given to reduce the requirement for graduate courses from seven to five

Residence Requirements

For the M.Sc. degree:

- at least one year of full-time study.

For the Ph.D. degree (from B.Sc.):

- at least three years of full-time study.

For the Ph.D. degree (from the M.Sc.):

- at least two years of full-time study.

Graduate Courses*

- Chemistry 65.509 (CHM8150)

Special Topics in Molecular Spectroscopy

Topics of current interest in molecular spectroscopy. In past years, the following areas have been covered: Electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids the presence of weak and strong resonant laser radiation.

- Chemistry 65.516 (CHM8170)

Quantum Chemistry

Molecular orbital theory and its application to chemistry. Self-consistent field method, results for diatomic molecules. Configuration interaction and molecular dissociation. Basis sets and molecular properties. *Ab initio* vs. semiempirical approaches. Correlation diagrams for chemical reactions. Polyatomic molecules and potential energy surfaces.

- Chemistry 65.517 (CHM8161)

Physical Chemistry of Solutions

Major theoretical approaches and experimental methods used in the study of liquids and solutions.

Prerequisites: A reasonable background knowledge in thermodynamics, quantum chemistry and statistical mechanics.

- Chemistry 65.519 (CHM8149)

Molecular Reaction Dynamics

State-to-state vs. bulk reaction kinetics. Trajectory approach to molecular reaction dynamics. Important experimental techniques: molecular beam reactions infrared chemiluminescence, laser-induced fluorescence, chemical lasers. Use of trajectory calculations to interpret experiments and to provide reaction mechanisms.

- Chemistry 65.520 (CHM8152)

Surface Chemistry and Catalysis

Absorption phenomena and isotherms, surface area of solids. Modern techniques in surface chemistry and surface science such as electron diffraction, Auger electron spectroscopy, photoelectron spectroscopy, electron energy loss spectroscopy, infrared and Raman spectroscopy. Current new techniques.

- Chemistry 65.522 (CHM8131)

Principles of Electrochemistry

Ion transport by migration and diffusion. The interaction between ions and solvent and the ions themselves. The structure of the interface between electrodes and solutions. The energetics of electron-transfer between phases. A similar description of the kinetics of electron transfer. Evolution of hydrogen and oxygen at electrodes.

- Chemistry 65.523 (CHM8141)

Advanced Electrochemistry

More advanced topics in electrochemistry. The subject matter of this course may change from year to year, according to recent developments in the field.

Prerequisite: A first course in electrochemistry.

- Chemistry 65.524 (CHM8151)

Electrochemistry at Interfaces

Introduction to electrode processes and electrolysis. Potential differences at interfaces. Characterization of the electrical double layer. Dipole orientation effects; charge transfer in absorbed layers; electrochemical origins of surface science concepts. Theory of electro transfer; electrode kinetics; electrocatalysis. Industrial applications; photoelectrochemistry.

- Chemistry 65.525 (CHM8129)

Chemistry of Natural Products

Synthesis of natural products. Strategies for development of a synthetic method. Preservation and development of chiral centers. Examples of synthesis are taken from the current literature; students will be asked to develop syntheses for various target molecules.

- Chemistry 65.526 (CHM8155)

Nucleic Acid Chemistry

A survey of nucleic acid chemistry from the organic chemist's perspective. Structure (chemistry and spectroscopy) and reactions of nucleosides, synthesis of nucleosides and oligonucleotides. Some molecular biology and chemistry of oligonucleotides and analogs, e.g. rare nucleosides, C-nucleosides, and useful drugs.

*All courses offered are half-course credits except 65.581 and 65.582 (which are full-course credit seminars). A list of current offerings will be available from the department prior to Fall registration.

• Chemistry 65.527 (CHM8121)

Organic Reaction Mechanisms

Advanced physical organic chemistry, including topics such as: Acidity functions, pK 's of organic compounds, steric and electronic effects in organic chemistry, molecular orbital theory and correlation diagrams, structure calculations using molecular mechanics.

• Chemistry 65.58 (CHM8133)

Multinuclear Magnetic Resonance Spectroscopy

Principles of Nuclear Magnetic Resonance (NMR). The NMR parameters to be studied are: Chemical shift, spin-spin coupling, electric quadrupole coupling, spin-spin and spin-lattice relaxation rates. NMR and the periodic table. Dynamic NMR. Applications in chemistry and biochemistry. The Fourier Transform technique. Pulse sequences. Basic principles and applications of two-dimensional NMR.

• Chemistry 65.533 (CHM8126)

Bioorganic Chemistry

Overview of recent developments in the general area of biocatalysis. Current examples of the biotransformation of organic compounds using enzyme models, abzymes, enzymes, immobilized enzymes, microbial cells and recombinant microbial cells. Biosynthetic procedures of industrial importance in waste management.

• Chemistry 65.539 (CHM8144)

Electron Transfer Reactions: Theory and Experiment
Bimolecular electron transfer theory as developed by Marcus in the 1950's. Experimental verification of Marcus theory. Recent advances in long-range intramolecular electron transfer. Particular emphasis will be given to the mechanism of electronic coupling between donor and acceptor.

• Chemistry 65.540 (CHM8114)

Special Topics in Non-Metal Chemistry

Topics of current interest in non-metal chemistry. The content of this course may vary from year to year.

• Chemistry 65.541 (CHM8117)

Organometallic Chemistry

Organometallic compounds and their chemistry. Types of bonding; methods of preparation; reactivity. Alkyl and aryl-metal compounds; alkene complexes; enyl-metal complexes; diene complexes; dienyl complexes; triene complexes; carbene and carbyne complexes. Introduction to cluster chemistry (polymetallic complexes).

• Chemistry 65.542 (CHM8115)

Special Topics in Inorganic Chemistry

Topics of current interest in inorganic chemistry. In the past, one course has covered Ceramics: binary and ternary phase diagrams and their thermodynamic basis; pyrometallurgical and ceramic thermochemistry; glasses; molten salts and solid solutions; defects; doping and preparation of pure materials; electrical and surface properties of ceramics.

• Chemistry 65.543 (CHM8112)

Methods in Analytical Chemistry

Important methods in analytical chemistry, and evaluation of competitive analytical techniques based on well-defined criteria for selection. Areas to be covered include: Analytical atomic spectroscopy, analytical electrochemistry, analytical chromatography, analytical molecular spectroscopy. This course provides a sound basis for choosing the best analytical techniques for a particular problem. The focus will be on: when a technique is applicable; limitations, advantages and disadvantages; detection limits, sensitivity and interferences; commercially available instrumentation.

• Chemistry 65.544 (CHM8125)

Organic Synthesis

A discussion of modern synthetic methodology, including new synthetic methods and the concept of strategy. The choice of target molecules and strategies discussed varies with the lecturer.

• Chemistry 65.545 (CHM8127)

Chemistry of Carbohydrates

Nomenclature. Chemistry and synthesis of carbohydrates. Chemical modifications. Chemistry and synthesis of flavinoids and carotenoids.

• Chemistry 65.547 (CHM8134)

Spectroscopy for Organic Chemists

Analysis of proton NMR spectra. Fourier transform ^{13}C NMR, strategies for structure elucidation relaxation times, two-dimensional NMR. Aspects of mass spectrometry.

• Chemistry 65.548 (CHM8122)

Special Topics in Organic Chemistry

Topics of current interest in organic chemistry. In the past one course has covered solid state NMR: Chemical aspects of solid state structure; molecular ordering and motion in the solid state; magnetic interactions; hydrogen, deuterium and ^{13}C NMR; experimental methods; applications; relationship between high resolution solid-state and solution NMR.

• Chemistry 65.549 (CHM8123)

Recent Advances in Organic Chemistry

Topics may vary from year to year. The course presently given contains: Analysis and description of natural product total synthesis through the chiron strategy, with emphasis on carbohydrates and amino acids as chiral building blocks. Strategy of protecting group chemistry, stereoelectronic effects, and use of enzymes in organic synthesis.

• Chemistry 65.550 (CHM8116)

Analytical Instrumentation

Principles of modern electronic instrumentation and their application in the chemical laboratory. Scientific instruments; measurement and control systems; microcomputer interfacing. Instrumentation concepts including feedback control, signal-to-noise enhancement, data acquisition, and signal processing will be

presented along with the techniques and devices for their implementation. A parallel laboratory is taught using modern test instruments. Examples include absorption spectrophotometer, derivative titration thermocouple, pH meter, and cyclic voltammetry.

- Chemistry 65.551 (CHM8220)

Problems in Organic Chemistry

The problems which are assigned in this course are of two types (1) written examinations on a particular topic in organic chemistry, (2) critical reviews of papers in the current organic literature, i.e. a simulated referee's report on the paper. In order to pass the course, eight "problems" must be solved satisfactorily.

- Chemistry 65.552 (CHM8110)

Analytical Approach to Chemical Problems

Case-study approach to a variety of problems in agricultural, biochemical, environmental, food processing, geological, industrial and surface sciences that can be solved by analytical chemistry. Comparative study of analytical methods appropriate to each case includes: capillary electrophoresis, chemiluminescence, electrochemical biosensors, Fourier transform infrared spectroscopy, inductively coupled plasma emission, neutron activation analysis, sensor arrays, secondary ion mass spectrometry, tandem mass spectrometry, and ultra-high resolution nuclear magnetic resonance spectroscopy. Modern data analysis techniques such as pattern recognition are also discussed.

- Chemistry 65.555 (CHM8119)

Analytical Atomic Spectroscopy: Absorption

Theories of atomic absorption spectroscopy. Various causes for line-broadening. Line width and line shape. Experimental methods of atomic absorption spectroscopy. Thermal and non-thermal atomization. Non-thermal atomization by cathodic sputtering in a glow discharge. Reactions in a pulse-heated furnace. Isothermal and non-isothermal atomization. Mechanisms of atom formation in and atom loss from various types of atomizers. Applications.

- Chemistry 65.556 (CHM8120)

Analytical Atomic Spectroscopy: Emission and Fluorescence

Theories of emission spectroscopy. Experimental methods of emission spectrometry. Excitation sources. High-temperature plasmas as excitation sources. Inductively-coupled plasma optical emission spectrometry. Mechanisms of excitation and de-excitation. Chemiluminescence. Theories of atomic fluorescence spectroscopy. Quenching collisions. Experimental methods. Lasers in atomic fluorescence spectrometry. Applications.

- Chemistry 65.561 (CHM8118)

Advanced Physical Inorganic Chemistry

Application of quantum theory to inorganic spectroscopy and magnetism. Use of quantum mechanics and group theory to identify states and processes in inor-

ganic spectroscopy. The basic theory is applied to structure analysis and prediction of reactions, and provides a model for inorganic photochemistry

Prerequisites: A reasonable background in quantum mechanics and group theory.

- Chemistry 65.570 (CHM8143)

Special Topics in Physical Chemistry

Topics of current interest in physical chemistry. The content of this course may change from year to year.

- Chemistry 65.571 (CHM8145)

Photochemistry

Photochemical reactions of small molecules and the relation to atmospheric chemistry. Lasers and applications to measurements of the dynamics of elementary reactions. Production and detection of reactive species. Energy transfer processes. Photolysis of formaldehyde and carbonyl compounds. Multiphoton absorption of infrared radiation.

- Chemistry 65.572 (CHM8135)

Theories of Chemical Reaction Rates

Concepts and theories of chemical kinetics. Significance of activation energy; transition state theory and more modern developments; reaction dynamics. Other optional topics include unimolecular gas reactions, theory of solvent effects, homogeneous and heterogeneous catalysis, and kinetic isotope effects.

- Chemistry 65.573 (CHM8137)

Advanced Chemical Kinetics

Study of the principles involving the exchange of translational, rotational, vibrational and electronic energy in molecular collisions. Influence of energy transfer processes on thermal unimolecular and bimolecular reactions. Study of the relationship between microscopic and macroscopic kinetics of elementary reactions.

- Chemistry 65.574 (CHM8142)

Symmetry in Chemistry

Introduction to group theory with emphasis upon irreducible representations. Application to molecular vibrations, molecular orbital theory and transition metal chemistry.

- Chemistry 65.575 (CHM8140)

Chemical Spectroscopy

Interaction of radiation with matter. Additional topics, which will depend on the nature of the class, will be chosen from the following: Perturbation methods for studying atomic spectra, fundamentals of ESR and NMR spectroscopies; rotational and vibrational spectra of diatomic and polyatomic molecules, group theory as applied to molecular vibrations.

Prerequisite: A background in quantum mechanics at the undergraduate level.

- Chemistry 65.576 (CHM8148)

Gas Phase Ion Chemistry

Structure, energetics and reaction kinetics of ions in the gas phase. Small organic ions, chemistry of free radicals, hypervalent species. Contemporary experimental methods in the physical chemistry of fast ion beams. Emphasis will also be upon recent work on novel ions and neutral species of relevance to interstellar chemistry.

- Chemistry 65.577 (CHM8138)

Enzyme Kinetics and Mechanism

Kinetic studies of enzymic reactions. Enzyme efficiency, specificity and versatility. Mechanisms and regulation of enzymic reactions. Analyses of enzymic systems.

- Chemistry 65.578 (CHM8156)

Principles and Mechanisms of Toxicology

Introduction to the principles of toxicology and methods of toxicological testing. Chemistry and mechanisms involved in the toxic action of selected toxins.

- Chemistry 65.579 (CHM8157)

Topics in Toxicology

In-depth studies of biochemical interactions between toxic substances and enzymatic systems. Emphasis will be placed on understanding the bio-organic and bio-inorganic mechanism of initial toxic events. Examples from mechanism failure, mechanism compensation and defensive behaviour will be given.

Prerequisite: Chemistry 65.578 (CHM8156)

- Chemistry 65.581 (CHM8256S)

Seminar I.

- Chemistry 65.582 (CHM8257S)

Seminar II.

- Chemistry 65.590 (CHM8158)

Directed Special Studies

Under unusual circumstances and with the recommendation of the research supervisor, it is possible to engage in directed study on a topic of particular value to the student. This may also be used for credit if there are insufficient course offerings in a particular field of chemistry.

- Chemistry 65.599 (CHM7999)

M.Sc. Thesis

- Chemistry 65.699 (CHM9999)

Ph.D. Thesis

The Ottawa-Carleton Geoscience Centre

Tory Bldg. 320
788-4400

The Centre

The centre, established in 1982, represents the combined research strengths of Carleton University and the University of Ottawa. Research facilities are shared between the two campuses and graduate students are enrolled in the university where their faculty supervisors hold appointments. Programs are available leading to the degrees of M.Sc. and Ph.D. in most areas of geoscience. Four areas of research are emphasized, each involving a major component of field work: Precambrian geology, structural geology and geodynamics, Arctic studies, and resource geology. The Derry Laboratory for Sedimentary Geochemistry and Mineral Deposits and the Geotechnical Science Laboratories are research units in the centre.

All thesis, seminar and examination requirements in the centre may be met either in French or English. Courses are offered in French wherever appropriate.

Members of the Centre

F.P. Agterberg, *Geomathematics*
C.R. Barnes, *Micropaleontology*
G.E. Bauer, *Geotechnical Engineering; Hydrology*
Keith Bell, *Isotope Studies; Petrology; Geochronology*
John Blenkinsop, *Mass Spectrometry; Geochronology*
A.C. Brown, *Sedimentary Ore Deposits*
R.L. Brown, *Structural Geology; Cordilleran Tectonics*
L.J. Cabri, *Mineralogy; Platinum-group Minerals*
E.M. Cameron, *Sedimentary Geochemistry and Mineral Deposits; Exploration Geochemistry*
G.Y. Chao, *Mineralogy; Crystallography*
I.D. Clark, *Hydrogeology*
André Desrochers, *Carbonate Sedimentology*
O.A. Dixon, *Invertebrate Paleontology; Stratigraphy; Canadian Arctic*
J.A. Donaldson, *Precambrian Stratigraphy and Sedimentology*
M.J. Drury, *Continental Deep-Drilling Program*
A.D. Fowler, *Igneous Petrology; Geochemistry; Evolution of Archean Metavolcanic Belts*
J.M. Franklin, *Ore Deposits; Hydrothermal Alteration*
H.M. French, *Permafrost and Periglacial Phenomena*
Edgar Froese, *Metamorphic Petrology; Thermodynamics*
W.K. Fyson, *Structural Analyses in Metamorphic Terrains*
M.-A. Geurts, *Palynology and Quaternary Environments of the Subarctic*
S.K. Hanmer, *Structural Geology; Progressive Strain; Microstructure*
Keiko Hattori, *Stable Isotope and Ore Geochemistry; Fluid Inclusions in Hydrothermal Ores*

D.D. Hogarth, *Mineralogy; Igneous and Metamorphic Petrology; Alkaline Rocks*
P.F. Hoffman, *Precambrian Geology*
C.W. Jefferson, *Sedimentary Ore Deposits*
J.P. Johnson, *Glacial & Periglacial Geomorphology; Glaciology; Remote Sensing; Quaternary Geology*
P.G. Johnson, *Glacial Geomorphology; Slope Mass Movements; Glacier Hydrology*
I.R. Jonasson, *Geochemistry; Ore Deposits*
P.G. Killeen, *Geophysics*
Ralph Kretz, *Petrology and Geochemistry of Metamorphic Rocks*
Jarmila Kukalova-Peck, *Paleontology; Fossil Insects*
A.E. Lalonde, *Petrology and Mineralogy of Granitic Rocks; Tectonic Implications of Plutonic Suites*
B.M. Lauriol, *Glacial and Periglacial Geomorphology, Chronology*
D.J. McLaren, *Geological Time; Event Stratigraphy*
F.A. Michel, *Isotope Geochemistry; Groundwater in Permafrost and Geothermal Regions*
J.M. Moore, *Metamorphic Petrology; Volcanology; Precambrian Geology*
Randall Parrish, *Geochronology, Metamorphic Petrology and Tectonics*
R.T. Patterson, *Neogene benthic foraminifera; palaeoecology, biostratigraphy*
Giorgio Ranalli, *Rheology of the Earth; Geodynamics; Plate Tectonics*
B.R. Rust, *Clastic Sedimentology (Recent and Ancient); Coal Basins*
D.F. Sangster, *Metallic Mineral Deposits; Geochemistry*
W.W. Shilts, *Quaternary Geology*
G.B. Skippen, *Metamorphic Petrology; Experimental Petrology; Aqueous Geochemistry*
M.W. Smith, *Permafrost, Microclimate, Soil Freezing*
B.E. Taylor, *Mineral Deposits; Stable Isotopes; Igneous Petrogenesis*
R.P. Taylor, *Fluid-rock Systems; Mineral Deposits*
J.K. Torrance, *Soil Chemistry and Geotechnical Properties*
Jan Veizer, *Sedimentary Geochemistry; Carbonates; Diagenesis; Ores; Precambrian Sedimentology*
D.H. Watkinson, *Metallic Mineral Deposits*
P.J. Williams, *Soil Freezing and Geotechnical Problems*
R.W. Yole, *Stratigraphy and Sedimentology; Petroleum Geology*

Research AssociateJ.W. Card, *Radiogenic Isotope Geochemistry*L.W. Diamond, *Geochemistry*

Postdoctoral FellowsDenis Bottomley, *Isotope Chemistry*C.P. Lowe, *Geodynamics*Moire Wadleigh, *Isotope Geochemistry*

Master of Science

Admission Requirements

The normal requirement for admission to the program is an honours B.Sc. degree, with at least high honours standing, in geology or a related discipline.

Program Requirements

- A research thesis, which will be defended at an oral examination
- Two graduate full courses
- Participation in the geoscience seminar series.

Academic Standing

A grade of B- or better must normally be received in each course counted towards the Master's degree.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is an M.Sc. degree in geology or a related discipline. Students who show outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc.

Program Requirements

- A research thesis, to be defended orally before an examination board which will include an external examiner
- A comprehensive examination, with emphasis on areas chosen by the student's advisory committee. The examination is normally taken within the first 12 months of study.
- Two graduate full courses
- Participation in the geoscience seminar series.

Residence Requirement

The normal residence requirement for the Ph.D. degree is at least four terms of full-time study.

Graduate Courses*

- Geology 67.511 (GEO5111)

Crystallography

Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.

G.Y. Chao.

- Geology 67.512 (GEO5112)

Rock-Forming Minerals

Recent work on structure, chemistry and interrelationships of igneous and metamorphic rock-forming minerals.

(To alternate with 67.513/GEO5113 or GEO5713)

D.D. Hogarth.

- Geology 67.513 (GEO5113)

Mineralogy of Plutonic Rocks

A seminar course reviewing the applications of mineralogical studies to the petrogenesis of felsic and mafic plutonic rocks. Topics include: structural state of feldspar minerals, applications to granitic rocks; chemical evolution of mica, pyroxene and amphibole minerals in plutonic bodies; phase relationships; review of the mineralogy of specific plutonic rock-types (e.g. anorthosites and syenites).

(To alternate with 64.512/GEO5112)

A.E. Lalonde.

- Geology 67.513 (GEO5713)

Minéralogie des Suites Plutoniques

Un cours ayant pour but d'accentuer la contribution des études minéralogiques détaillées à l'élaboration de la pétrogénèse des roches plutoniques mafiques ou felsiques. Parmi les sujets couverts figurent: la mise en ordre des feldspaths, son évaluation et ses applications à l'étude des granites, l'évolution chimique des micas, pyroxènes et amphiboles, relations de phases ainsi qu'une revue de la minéralogie de suites plutoniques spécifiques tels que les anorthosites, les syénites et les granites hyperalumineux.

A.E. Lalonde.

- Geology 67.521 (GEO5121)

Igneous Petrogenesis

Concentration on one or more of: origin and differentiation of basaltic magma; origin of granites; computer modelling of partial melting and fractional crystallization; magmatism in time and space. Laboratory and lecture material linked together in project form.

(Also offered as GEO5721)

Anthony Fowler, R.P. Taylor.

*All courses offered are half courses unless otherwise stated.

- **Geology 67.521 (GEO5721)**

Pétrogenèse Ignée

Un cours basé sur un (ou plusieurs) des thèmes suivants: origine et différenciation de magma basaltique; origine de granites; simulation par ordinateur de fusion partielle et cristallisation fractionnée; magmatisme en temps et en espace. Laboratoire et cours qui s'enchaînent sous forme d'un projet.

Anthony Fowler.

- **Geology 67.522 (GEO5122)**

Physical Volcanology

The distribution, classification and physical characteristics of volcanos and other volcanic landforms; lava flows, tephra, breccias and other rocks formed through volcanic activity. Volcanic environments; recognition of ancient volcanic features; case histories.

- **Geology 67.523 (GEO5123)**

Metamorphic Petrology

Thermodynamics and kinetics of mineral reactions; metamorphic zones and isograds; mass transfer; regional and global aspects of metamorphism.

Ralph Kretz, J.M. Moore.

- **Geology 67.524 (GEO5124)**

Metallic Mineral Deposits

Relationships of some metallic mineral deposits to igneous rocks: topics range from oxides and sulfides in and around intrusions to stratiform volcanogenic deposits. Course concludes with a field trip to northern Ontario and Quebec at end of winter term.

D.H. Watkinson.

- **Geology 67.525 (GEO5125)**

Sedimentary Mineral Deposits I

Mineral deposits of sedimentary affiliation, including those of iron, phosphorite, Mississippi Valley-type lead-zinc, sandstone-hosted base metals and uranium, sedimentary exhalative base metal, manganese, barite, and Kupferschiefer-type copper. Geological characteristics of world-class examples of each of these deposit-types.

D.F. Sangster, A.C. Brown.

- **Geology 67.526 (GEO5126)**

Sedimentary Mineral Deposits II

Interrelationships among the deposits covered in Sedimentary Mineral Deposits I and their sedimentary environments; isotopic and geochemical features; metallogenic characteristics; control by Earth evolutionary processes.

Prerequisite: Geology 67.525 (GEO5125) or permission of the instructors.

D.F. Sangster, A.C. Brown.

- **Geology 67.527 (GEO5127)**

Physical Processes in Igneous Petrology

Lecture, reading and seminar course dealing with the physical processes responsible for generation, ascent, crystallization and cooling of igneous rocks. Topics

covered include partial melting in the upper mantle and separation of the liquid; magma properties, structure, viscosity, temperature, density, and heat; magma processes, intrusion, extrusion, diffusion, convection types, assimilation, nucleation, and crystal growth; cooling of magmas, conduction, convection, permeability, vapour phase exsolution, meteoric water, development of spinifex, spherulites. These processes will be related to field examples wherever possible.

Anthony Fowler.

- **Geology 67.527 (GEO5727)**

Les Processus Physiques en Pétrologie Ignée

Les processus responsables directement à la génération, l'ascension, la croissance et le refroidissement des roches ignées seront présentés dans les cours, les colloques et dans la discussion de la littérature récente. Les sujets suivants seront traités: fusion dans le manteau et la séparation du liquide; propriétés des magmas, la structure, la viscosité, la température, la densité et la chaleur; les processus magmatiques, l'intrusion, l'extrusion, la diffusion, la convection, la perméabilité, l'exsolution d'une vapeur, l'eau météorique, le développement de spinnifex et les sphérulites. Les processus seront étudiés à l'aide d'exemples de terrain chaque fois que ça sera possible.

Anthony Fowler.

- **Geology 67.531 (GEO5131)**

Sedimentology and Stratigraphy

Selected problems in sedimentary geology, emphasizing sedimentary structures, facies models and diagenesis. The application of modern techniques of stratigraphic, petrologic and statistical analysis.

J.A. Donaldson, B.R. Rust.

- **Geology 67.532 (GEO5132)**

Paleoecology

Emphasis on marine fossils as paleoenvironmental indicators: effects of substrate type, energy conditions, light, temperature, biotic associates and other environmental factors on the occurrence and distribution of organisms and their fossil remains.

O.A. Dixon, R.T. Patterson.

- **Geology 67.533 (GEO5133)**

Advanced Micropaleontology

Seminar course providing a more in-depth examination of selected topics in micropaleontology than covered in "Marine Geology and Micropaleontology (67.431*)". Topics include systematics, paleoecology, and the biostratigraphic and paleoceanographic applications of various microfossil groups.

R.T. Patterson

- **Geology 67.534 (GEO5134)**

Fossil Fuels

Petroleum, natural gas, coal and unconventional fossil fuels; their origin, occurrence, and evaluation in the light of current geological thought.

R.W. Yole.

- **Geology 67.541 (GEO5141)**

Permafrost Hydrology and Investigative Methods

An examination of groundwater flow in permafrost regions. The importance of groundwater in the formation of various types of ground ice, and the effect of groundwater flow on permafrost distribution.
F.A. Michel.

- **Geology 67.542 (GEO5142)**

Environmental Geoscience

A study-seminar course in which students will examine, in depth, certain environmental problems, including geological hazards, mineral and energy consumption and environmental degradation. The relation between development and the environment will be considered. Students will prepare a report and present a seminar on a subject of their choice, and will participate in a research project centred in the Ottawa area.
Ralph Kretz

- **Geology 67.551 (GEO5151)**

Precambrian Geology

Problems of Precambrian geology, emphasizing classical and current studies in North America; comparative study of the Canadian Shield and other Precambrian shields; research projects, field trips and petrologic studies of representative rock suites.
J.A. Donaldson.

- **Geology 67.552 (GEO5152)**

Geology of Arctic Canada

Origins and development of the principal geological regions of the Canadian Arctic. Emphasis on the Phanerozoic record but other topics or problems may be included.
O.A. Dixon.

- **Geology 67.560 (GEO5160)**

Chemistry of the Earth

An investigation of the geochemical constitution of the Earth and how the Earth has evolved. Topics will include meteorites and the early history of the Earth; chemical and isotopic constraints on the geochemical evolution of the crust and mantle; Earth models and their limitations.
John Blenkinsop.

- **Geology 67.561 (GEO5161)**

Low-Temperature Geochemistry

Geochemistry of sedimentary rocks and geochemical cycles; geochemical facies analysis, behaviour of elements and isotopes during sedimentation, diagenesis and epigenesis; geochemical evolution of sedimentary rocks during geologic history.
Keiko Hattori, Jan Veizer.

- **Geology 67.562 (GEO5162)**

Physical Geochemistry

Application of thermodynamics to geologic problems. Experimental study of mineral equilibria.
G.B. Skippen.

- **Geology 67.563 (GEO5163)**

Stable Isotope Geochemistry

Mechanisms of isotope fractionation in nature; physical and chemical isotope fractionation, kinetic isotope effects. Variations of stable isotope ratios (hydrogen, carbon, oxygen and sulphur) in nature. Preparation techniques of natural samples for isotope analysis. Applications of stable isotopes to study magma genesis, ore genesis, nature of water and formation fluids and sedimentary environments.
Keiko Hattori.

- **Geology 67.564 (GEO5164)**

Basin Evolution and Mineralization

Classification of sedimentary basins, tectonism and subsidence, P-T evolution, compaction and porosity development, hydrology, diagenesis, oil generation and migration, evolution of brines, transport of ore constituents, traps, evolution of mineralization through time.
Jan Veizer.

- **Geology 67.566 (GEO5166)**

Exploration Geochemistry

Selected topics in applied geochemistry including: biogeochemical exploration; element mobilities in the surface environment; recent developments in data interpretation; quality control of geochemical data. Special attention to the use of geochemical methods for gold exploration and possible applications of stable and radiogenic isotopes to mineral exploration.
E.M. Cameron.

- **Geology 67.567 (GEO5167)**

Hydrothermal Fluids

Liquids, vapours, supercritical fluids as the agents of rock-water interaction and mass transfer in the Crust. Phase relations in systems such as NaCl-H₂O-CO₂ and thermodynamic constraints on geologic fluids. Applications to mineral equilibria and the microscopic study of fluid inclusions.
G.B. Skippen.

- **Geology 67.568 (GEO5168)**

Mineralized Hydrothermal Systems

Geology of active geothermal systems, generation of hydrothermal fluids, geochemistry of hydrothermal fluids, stability and solubility of minerals in base-metal and precious-metal mineralization, interpretation of fluid inclusion data.
Keiko Hattori.

- **Geology 67.569 (GEO5169)**

(formerly Geology 67.565 (GEO5165))

Radioisotope Geochemistry

Nucleosynthesis; chemical differentiation of the earth. Evolution of large scale reservoirs. Isotopic tracers (¹⁴³Nd/¹⁴⁴Nd, ⁸⁷Sr/⁸⁶Sr, common Pb). Geochronology: fundamentals and application of Sm/Nd, Rb/Sr, U/Pb, K/Ar and Lu/Hf methods. Evolution of the solid earth from the isotopic perspective.
Keith Bell.

- **Geology 67.571 (GEO5171)**

Physics of the Earth

The physics and dynamics of the solid earth: seismology; gravitational and magnetic fields; thermal state. Geophysical constraints on the structure and composition of the interior. Geodynamic processes.

Giorgio Ranalli.

- **Geology 67.572 (GEO5172)**

Tectonophysics

The physics of deformation: continuum mechanics approach (elasticity, strength, plasticity, viscosity), and microrheological approach (diffusion, dislocations, and flow mechanisms). Applications to tectonic processes.

Giorgio Ranalli.

- **Geology 67.573 (GEO5173)**

Structural Geology

Selected problems in structural geology treated in seminar and laboratory sessions. Emphasis on the interpretation of fabrics developed during synmetamorphic strain. Students investigate and report on individual projects.

R.L. Brown, W.K. Fyson.

- **Geology 67.574 (GEO5174)**

Tectonics

An investigation of the structural style of mountain belts and their tectonic setting; tectonics of Precambrian deformed belts.

R.L. Brown, W.K. Fyson.

- **Geology 67.590 (GEO5190)**

Directed Studies

Directed reading and/or laboratory studies for full-course credit, under the guidance of selected extramural or intramural directors.

- **Geology 67.591 (GEO5191)**

Directed Studies

Directed reading and/or laboratory studies for half-course credit, under the guidance of selected extramural or intramural directors.

- **Geology 67.593 (GEO5193)**

Field Studies

Systematic investigations of geological problems, based on a minimum of 15 days field work plus related library research and laboratory projects. Written report required.

- **Geology 67.594 (GEO5294)**

Problems in Historical Geology and Geological Time
Controversial ideas concerning the earth and time; historical development of thought on the physical and biological evolution of the earth. Understanding the stratigraphic column in regard to duration, age and correlation, including evidence from paleontology and sedimentology, particularly gaps in the succession and rhythmic or episodic events. Origin and nature of life; relationship between crustal events and evolution,

including extinctions. Concepts and models in geology; responsibility of the geologist to humanity. Half-course given during fall and winter terms.

D.J. McLaren.

- **Geology 67.599 (GEO7999)**

M.Sc. Thesis

A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

- **Geology 67.699 (GEO9999)**

Ph.D. Thesis

A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

The following Geography courses are included in the centre's program:

Department of Geography, Carleton University:

- **Geography 45.530W1**

Soil Thermal and Hydrologic Regimes

Characteristics of soil regimes, particularly in freezing soils; role of soil properties; analytical and numerical methods, including computer simulation.

M.W. Smith.

- **Geography 45.532F1**

Soil Thermal and Hydrologic Properties

Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface, laboratory instrumentation and analysis of laboratory and field procedures in geotechnical science.

P.J. Williams.

- **Geography 45.533W1**

Periglacial Geomorphology

Permafrost, its distribution and significance, seasonal ground freezing, ground thermal regime, physical, thermodynamic, and geotechnical properties of freezing and thawing soils, terrain features ascribable to frost action, and solifluction and patterned ground.

P.J. Williams.

- **Geography 45.534W1**

Aspects of Clay Mineralogy and Soil Chemistry

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

J.K. Torrance.

Department of Geography, University of Ottawa:

- **GEG 5001**

Seminar: Earth Sciences (full course)

- **GEG 5303**

Process in Geomorphology: Physics of Media, Mechanics of Movement and Topographic Expression
Discussion of the physics of medium deformation as the basis of landscape-forming processes (ice, water and earth surface materials), the mechanics and effects of movement on the earth's surface, and concepts of landscape evolution due to the spatial and temporal variations of these processes.

• GEG 5703

Concepts Climatiques en Paléogéographie de l'Holocène dans le Nord du Canada

Le cours examine: 1) les causes et les mécanismes des variations climatiques de la fin du pléistocène et de l'holocène et leur impact sur les paysages; et, 2) les méthodes d'acquisition et d'interprétation des données indirectes (palynologie, géomorphologie, analyses isotopiques. . .).

Information and Systems Science Committee

Chairman's Office: 788-5733

or see the Department of Mathematics; Department of Systems and Computer Engineering; or the School of Computer Science

The Committee

Chair of the Committee: J.W. Chinneck

The program of graduate study and research leading to the degree of Master of Science in Information and Systems Science is offered by the Committee with the cooperation of the Department of Systems and Computer Engineering, the Department of Mathematics and Statistics, and the School of Computer Science.

The purpose of the program is to provide training in the use and application of computers to those who have not studied extensively in this field at the undergraduate level. The process of using the computer in problem-solving is stressed. The program is flexible, though individual concentrations are usually in one of three broad areas:

- computer applications in a particular field (e.g. communications, energy systems),
- algorithms and methodologies for solution of complex problems by computer (e.g. graph theory, operations research, optimization, simulation and modelling),
- computer methods and technologies (e.g. databases, software engineering, computer languages).

Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Master of Science

Admission Requirements

Applicants should have an honours bachelor's degree, or equivalent, with at least high honours standing, in mathematics, engineering, physics, chemistry, computer science, operations research, experimental psychology, econometrics, management science, or a related discipline. Undergraduate preparation should include at least two full courses in computing and a minimum of three full courses in mathematics, at least one of

which is at the third-year level or higher. In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admissions to the program will be made through one of the three participating departments. Since space and laboratory facilities will be provided by one of the departments, students should apply through the department with which they wish to be most closely associated.

Program Requirements

The normal program comprises eight half-courses and a thesis having a weight of 1½ full courses; additional requirements may also be stipulated, depending upon the individual student's background. With the approval of the committee, students who have substantial work experience may be permitted to substitute three additional half-courses in place of the thesis, one of which must be a graduate project course.

Students must take at least two half-courses from the department in which they are registered, and at least one half-course from each of the other two participating departments. Students must also take course 93.582 Introduction to Information and Systems Science.

Each student should consult with his/her faculty adviser in the selection of a course pattern related to his/her principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his/her thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University; however, a candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the committee.

Graduate Courses*

• Information and Systems Science 93.582F1
Introduction to Information and Systems Science
An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queueing systems, optimization.
(Also listed as Mathematics 70.582, Engineering 94.582, Computer Science 95.592).

• Information and Systems Science 93.598F3, W3, S3
M.Sc. Thesis in Information and Systems Science
(Also listed as Mathematics 70.598, Engineering 94.598, Computer Science 95.598).

Department of Mathematics and Statistics

Undergraduate Courses:

- 70.301 Real Analysis I
- 70.302 Real Analysis II
- 70.310 Modern Algebra
- 70.350 Mathematical Statistics
- 70.403 Functional Analysis
- 70.451 Probability Theory
- 70.452 Sampling Theory and Methods I
- 70.453 Applied Multivariate Analysis
- 70.456 Non-Parametric Methods I
- 70.457 Statistical Inference
- 70.458 Stochastic Models
- 70.459 Stochastic Optimization
- 70.470 Partial Differential Equations I
- 70.471 Partial Differential Equations II
- 70.473 Qualitative Theory of Ordinary Differential Equations
- 70.482 Introduction to Mathematical Logic
- 70.483 Topics in Applied Logic
- 70.485 Theory of Automata
- 70.486 Numerical Analysis
- 70.487 Game Theory
- 70.496 Directed Studies

Graduate Courses:

- 70.507 Real Analysis I (Measure Theory and Integration)
- 70.508 Real Analysis II (Functional Analysis)
- 70.517 Algebra I
- 70.519 Algebra II
- 70.552 Sampling Theory and Methods
- 70.553 Linear Models

- 70.554 Stochastic Processes and Time Series Analysis
- 70.555 Design of Experiments
- 70.556 Robust Statistical Inference
- 70.557 Advanced Statistical Inference
- 70.558 Topics in Stochastic Processes
- 70.559 Multivariate Analysis
- 70.561 Stochastic Optimization
- 70.565 Theory of Automata
- 70.567 Game Theory
- 70.569 Topics in Combinatorial Mathematics
- 70.571 Stochastic Models
- 70.581 Linear Optimization
- 70.583 Nonlinear Optimization
- 70.584 Topics in Operations Research
- 70.585 Topics in Algorithm Design
- 70.586 Numerical Analysis
- 70/95.587 Formal Language and Syntax Analysis
- 70.588 Combinatorial Optimization
- 70.589 Combinatorial Optimization
- 70.590 Seminar
- 70.591 Directed Studies
- 70.593 Project

Department of Systems and Computer Engineering

Undergraduate courses:

- 94.301 Operating Systems
- 94.303 Real-Time Computing Systems
- 94.310 Systems Analysis
- 94.351 Communication Systems
- 94.361 Microprocessor Systems
- 94.405 Discrete Simulation and its Applications
- 94.433 Advanced Real-Time Programming
- 94.445 Discrete Time Systems
- 94.457 Introduction to the Architecture of Computer Systems
- 94.460 Data Communications
- 94.480 Software Engineering
- 94.481 Software Engineering Project
- 94.485 Computer Systems Design Laboratory

Graduate Courses:

- 94.501 Simulation and Modelling
- 94.504 Computer Methods in Industrial Engineering
- 94.505 Optimization Theory and Methods
- 94/95.507 Expert Systems
- 94.511 Computer System Design for Performance
- 94.517 Queueing Systems
- 94.518 Topics in Information Systems
- 94.519 Teletraffic Engineering
- 94.521 Computer Communication
- 94.527 Distributed Processing Systems
- 94.531 System Design with ADA
- 94.532 Systems Design
- 94.533 Digital Systems Engineering
- 94.535 Representations and Methods in Design Tools for Concurrent Systems

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- | | | | |
|--------|--|-----------|--|
| 94.538 | Computer Architecture and Parallel Processing | 95.503 | Principles of Distributed Computing |
| 94.539 | Advanced Topics in Digital Systems Design | 95.504 | Topics in Arithmetic Complexity |
| 94.540 | Topics in Office Automation | 95.505 | Automata Models of Learning Systems |
| 94.541 | Adaptive Control | 95.506 | Natural Language Processing |
| 94.542 | Advanced Dynamics with Applications to Robotics | 94/95.507 | Expert Systems |
| 94.552 | Advanced Linear Systems | 95.508 | Computational Geometry |
| 94.553 | Stochastic Processes | 95.509 | Design of Information Retrieval Systems |
| 94.554 | Principles of Digital Communication | 95.510 | Topics in Artificial Intelligence |
| 94.557 | Fundamentals of Discrete Systems | 95.511 | Distributed Databases and Transaction Processing Systems |
| 94.558 | Digital Systems Architecture | 95.512 | Advanced Operating Systems |
| 94.560 | Adaptive Signal Processing | 95.513 | Cryptography |
| 94.562 | Digital Signal Processing | 95.514 | Object-Oriented Systems |
| 94.563 | Digital Signal Processing Hardware, Software and Applications | 95.574 | Parallel Algorithms and their VLSI Implementation |
| 94.564 | Advanced Topics in Digital Signal Processing: Speech Communications and Applications | | |
| 94.565 | Advanced Digital Communication | | |
| 94.567 | Source Coding and Data Compression | | |
| 94.568 | Mobile Communications Systems | | |
| 94.569 | Digital Television | | |
| 94.571 | Mini/Microcomputer Operating System Design | | |
| 94.573 | Integrated Database Systems | | |
| 94.574 | Elements of Computer Systems | | |
| 94.576 | Analytical Performance Models of Computer Systems | | |
| 94.577 | Teleprocessing Software Design | | |
| 94.579 | Advanced Topics in Software Engineering | | |
| 94.581 | Advanced Topics in Computer Communications | | |
| 94.583 | Logic Programming | | |
| 94.584 | Advanced Topics in Communications Systems | | |
| 94.585 | Logic Programming: Techniques and Applications | | |
| 94.589 | Advanced Topics in Measurements and Models | | |
| 94.596 | Directed Studies | | |

Due to the interdisciplinary nature of ISS, a student will in some cases benefit by taking an undergraduate course at the 300 or 400 level as part of his/her program. Where a 300 level course is to be taken, it will be extra to the degree requirements, or else arrangements will be made to enrich the subject matter, normally through a directed study course with the professor. Students may include two half-courses at the 400 level in their program without penalty, with the approval of the department. The 300 and 400 level courses listed here are those most likely to interest ISS students; see the undergraduate calendar for a complete list.

School of Computer Science

Undergraduate Courses:

- 95.300 Operating Systems
- 95.304 Software Systems Design
- 95.305 Database Management Systems
- 95.401 Concurrent Programming
- 95.402 Computer Graphics
- 95.403 Transaction Processing Systems
- 95.404 System Software
- 95.405 First Course in Robotics and Computer Vision
- 95.407 Applied Artificial Intelligence

Graduate Courses:

- 95.501 Foundations of Programming Languages
- 95.502 End-User Facilities

Institute for Graduate Studies and Research in Mathematics and Statistics

Dunton Tower 712
788-2155

The Institute

Director of the Institute: M.J. Moore

Associate Director: G. Ivanoff

Students who wish to pursue studies in pure mathematics, applied mathematics, probability and statistics at the graduate level leading to an M.Sc. or a Ph.D. degree can do so in a joint program offered by the Department of Mathematics and Statistics at Carleton University and the Department of Mathematics at the University of Ottawa under the auspices of the Institute for Graduate Studies and Research in Mathematics and Statistics. The institute is responsible for supervising the programs, regulations and student admissions, as well as providing a framework for interaction between the two departments at the research level.

The principal research interests of members of the institute include the following fields:

Pure Mathematics

Analytic inequalities, category theory, differential equations, fixed-point theory, functional analysis, generalized functions, geometry, group theory, harmonic analysis, homological algebra, Jordan algebras, number theory, representations of algebras, representations of Lie groups, ring theory, topology

Applied Mathematics

Applied analysis, analysis of algorithms, automata theory, coding theory, combinatorial optimization, control theory, numerical analysis, operations research, special functions

Probability and Statistics

Estimation theory, experimental design, foundations of statistical inference, invariance principles, multivariate analysis, probability in Banach spaces, sampling theory, sequential analysis, statistical methods, stochastic processes.

In addition to the programs administered by the institute, the Department of Mathematics and Statistics at Carleton University offers several other programs.

In co-operation with the Department of Systems and Computer Engineering and the School of Computer Science at Carleton University, students may pursue a program leading to an M.Sc. in Information and Systems Science, for information see page 142.

In co-operation with the School of Computer Science and the Department of Systems and Computer Engineering at Carleton University and the Department of Computer Science at the University of

Ottawa, students may pursue a program leading to a Master of Computer Science (M.C.S.); for information see page 160.

The Department of Mathematics and Statistics also offers a co-operative master's program in statistics in collaboration with the federal government, emphasizing practical training through work experience, along with sound training in statistical inference and basic probability theory; for further information contact the department directly.

Master of Science

Admission Requirements

The normal requirement for admission to the master's program is an honours bachelor's degree in mathematics, or the equivalent, with at least high honours standing. Applicants holding a general (pass) degree with at least high honours standing may be admitted to a qualifying-year program. Their subsequent admission to the regular master's program depends on their performance during the qualifying-year program and will be decided no later than one year after admission to the qualifying-year program. Details are outlined in the general section of this calendar.

Students with outstanding academic performance and research promise while in the M.Sc. programme may be permitted to transfer to the Ph.D. programme without completing the M.Sc. programme.

Program Requirements

The two options for the M.Sc. program are:

- Eight one-term courses (or equivalent) and a thesis
- Ten one-term courses (or equivalent).

The courses must be chosen from those at the graduate level except that a student may take up to two one-term approved undergraduate courses at the fourth-year level to satisfy these requirements. Not all these courses may be taken in the same field of mathematics; at least two must be in another field. All master's students are required to participate actively in a seminar or project under the guidance of his/her adviser. A maximum of two one-term courses taken outside of the Department of Mathematics and Statistics at Carleton University or the Department of Mathematics at the University of Ottawa may be allowed for credit.

Students who plan to specialize in probability and statistics are strongly advised that during their master's

program they include, where possible, the courses 70.450, 70.551 in mathematical statistics; 70.452, 70.555 in applied statistics, and 70.451, 70.571 in probability, together with two further one-term courses in the Department of Mathematics and Statistics. In addition, a graduate course in another field, such as biology, biostatistics, economics, computer science, systems analysis, and stochastic modelling, is highly recommended.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mathematics, or the equivalent, with at least high honours standing. Details are outlined in the general section of this calendar.

Program Requirements

The course requirements, which are determined at the time of admission, include a minimum of six one-term graduate courses (or equivalent) and a suitable thesis. Not all of these courses may be taken in the same field of mathematics; at least two must be in another field.

All candidates must take a comprehensive examination, and satisfy a language requirement. The language requirement is determined by the candidate's advisory committee and normally requires the ability to read mathematical literature in a language considered useful for his/her research or career, and other than the candidate's principal language of study.

A comprehensive examination will be undertaken in the following areas:

- The candidate's general area of specialization at the Ph.D. level
- A basic examination on two topics chosen from algebra, analysis, probability, and topology. (This choice excludes the student's specialty.)

This examination must be completed successfully within 18 months of initial registration into the Ph.D. program in the case of a full-time student, and within 36 months of initial registration in the case of a part-time student.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the department of Mathematics and Statistics, be selected by master's candidates in partial fulfilment of their degree requirements:

Mathematics and Statistics

- 70.401 Vector Calculus
- 70.403 Functional Analysis
- 70.407 Measure Theory
- 70.415 Rings and Modules
- 70.416 Group Theory
- 70.417 Commutative Algebra
- 70.418 Homological Algebra and Category Theory
- 70.425 Introduction to General Topology
- 70.426 Introduction to Algebraic Topology
- 70.427 Foundations of Geometry
- 70.428 Introduction to Differentiable Manifolds
- 70.435 Analytic Number Theory
- 70.436 Algebraic Number Theory
- 70.445 Analytical Dynamics
- 70.446 Hydrodynamics and Elasticity
- 70.447 Tensor Analysis and Relativity Theory
- 70.450 Parametric Estimation
- 70.451 Probability Theory
- 70.452 Sampling: Theory and Methods I
- 70.453 Applied Multivariate Analysis
- 70.456 Non-Parametric Methods
- 70.457 Statistical Inference
- 70.458 Stochastic Models
- 70.459 Stochastic Optimization
- 70.470 Partial Differential Equations I
- 70.471 Partial Differential Equations II
- 70.472 Integral Transforms
- 70.473 Qualitative Theory of Ordinary Differential Equations
- 70.482 Introduction to Mathematical Logic
- 70.483 Topics in Applied Logic
- 70.484 Design and Analysis of Algorithms
- 70.485 Theory of Automata
- 70.486 Numerical Analysis
- 70.487 Game Theory
- 70.488 Graph Theory and Algorithms

Graduate Courses*

- Mathematics 70.501W1 (MAT5120)

Abstract Measure Theory

Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier transforms.

Prerequisite: Mathematics 70.407.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• **Mathematics 70.502F1 (MAT5123)**

Distributions and Generalized Functions

Linear topological spaces, countably multinormed spaces, countable union spaces and their duals, testing function spaces, spaces of generalized functions and their structure, Schwartz distributions, calculus of distribution, convolution, analytic representation, and Fourier transform of distributions.

Prerequisite: Mathematics 70.403.

• **Mathematics 70.503F1 (MAT5122)**

Banach Algebras

Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element; special types of Banach algebras: for example, regular algebras, algebras with involution; applications.

• **Mathematics 70.504W1 (MAT5129)**

Integral Equations

A survey of the main results in the theory of non-singular linear integral equations; Volterra and Fredholm equations of first and second kind in the L_2 case, with special results for the continuous case; Hermitian kernels; eigen-function expansions; compact operators.

Prerequisites: Mathematics 70.302 and 70.403.

• **Mathematics 70.505F1 (MAT5127)**

Complex Analysis

Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.

• **Mathematics 70.506F1 (MAT5316)**

Topological Vector Spaces

Construction of new topological vector spaces out of given ones; local convexity and the Hahn-Banach theorem; compactness and the Krein-Milman theorem; conjugate spaces, polar sets.

Prerequisite: Mathematics 70.403.

• **Mathematics 70.507F1 (MAT5125)**

Real Analysis I (Measure Theory and Integration)

General measure and integral, Lebesgue measure and integration on \mathbb{R} , Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute continuity and differentiation, LP-spaces. Selected topics such as: Daniell-Stone theory.

Prerequisites: Mathematics 70.301 and 70.302 (MAT3125) or permission of the department.

• **Mathematics 70.508W1 (MAT5126)**

Real Analysis II (Functional Analysis)

Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak- and weak*-topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems.

Prerequisite: Mathematics 70.507 (MAT5125) or permission of the department.

• **Mathematics 70.509F1 (MAT5121)**

Introduction to Hilbert Space

Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.

Prerequisites: Mathematics 70.301, 70.302, and 70.403.

• **Mathematics 70.512F1 (MAT5148)**

Group Representations and Applications

An introduction to group representations and character theory, with selected applications.

• **Mathematics 70.513F1 (MAT5146)**

Rings and Modules

Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.

• **Mathematics 70.514F1 (MAT5143)**

Lie Algebras

Basic concepts: ideals, homomorphisms, nilpotent, solvable, semi-simple. Representations, universal enveloping algebra. Semi-simple Lie algebras: structure theory, classification, representation theory.

Prerequisites: Mathematics 70.517 (MAT5141) and 70.519 (MAT5142) or permission of the department.

• **Mathematics 70.516W1 (MAT5145)**

Group Theory

Fundamental principles as applied to abelian, nilpotent, solvable, free, and finite groups; representations.

Prerequisite: Mathematics 70.310 or permission of the department.

• **Mathematics 70.517F1 (MAT5141)**

Algebra I

Groups, Sylow subgroups, finitely generated abelian groups. Rings, field of fractions, principal ideal domains, modules. Polynomial algebra, Euclidean algorithm, unique factorization.

Prerequisite: Permission of the department.

• **Mathematics 70.518W1 (MAT5147)**

Homological Algebra and Category Theory

Axioms of set theory, categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory.

Prerequisite: Mathematics 70.310 or permission of the department.

• **Mathematics 70.519W1 (MAT5142)**

Algebra II

Field theory, algebraic and transcendental extensions, finite fields, Galois groups. Modules over principal ideal domains, decomposition of a linear transformation, Jordan normal form.

Prerequisites: Mathematics 70.517 (MAT5141) and permission of the department.

• **Mathematics 70.521W1 (MAT5150)**

Topics in Geometry

Various axiom systems of geometry. Detailed exami-

nations of at least one modern approach to foundations, with emphasis upon the connections with group theory.

Prerequisite: Permission of the department.

• Mathematics 70.522F1 (MAT5168)

Homology Theory

The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.

Prerequisite: Mathematics 70.425.

• Mathematics 70.525F1 (MAT5151)

Topology I

Topological spaces, product and identification topologies, countability and separation axioms, compactness, connectedness, metrization, net and filter convergence.

Prerequisite: Mathematics 70.301 or permission of the department.

• Mathematics 70.526 W1 (MAT5152)

Topology II

Homotopy, fundamental group, covering spaces, complexes, classification of two-dimensional manifolds.

Prerequisites: Mathematics 70.310 (MAT3143) and 70.525 (MAT5151) or permission of the department.

• Mathematics 70.527F1 (MAT5169)

Foundations of Geometry

A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry.

Prerequisite: Mathematics 70.310 (may be taken concurrently) or permission of the department.

• Mathematics 70.528F1 (MAT5155)

Differentiable Manifolds

A study of differentiable manifolds from the point of view of either differential topology or differential geometry. Topics such as smooth mappings, transversality, intersection theory, vector fields on manifolds, Gaussian curvature, Riemannian manifolds, differential forms, tensors, and connections are included.

Prerequisite: Mathematics 70.301 or permission of the department.

• Mathematics 70.535F1 (MAT5163)

Analytic Number Theory

Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms.

Prerequisite: Mathematics 70.307 or permission of the department.

• Mathematics 70.536W1 (MAT5164)

Algebraic Number Theory

Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number.

Prerequisite: Mathematics 70.310 or permission of the department.

• Mathematics 70.540F1 (MAT5185)

Advanced Classical Mechanics

Hamiltonian dynamics, integral invariants, non-holonomic systems, rigid body motions.

Prerequisite: Mathematics 70.345 or permission of the department.

• Mathematics 70.541F1 (MAT5320)

Calculus of Variations

Extreme values of functionals; necessary conditions for an extremum. Sufficient conditions for an extremum. Hamilton-Jacobi Theory and the Maximum Principle of Pontryagin. The problem of Lagrange: the Isoperimetric problem.

Prerequisite: Mathematics 70.345 or permission of the department.

• Mathematics 70.542W1 (MAT5186)

Special Functions

Hypergeometric and Generalized Hypergeometric functions; classical orthogonal polynomials in discrete and continuous variables. Confluent, Hypergeometric and Bessel functions. Asymptotic expansions; steepest descent, WKB approximation and other asymptotic methods.

Prerequisites: Mathematics 70.307 and 70.308, or permission of the department.

• Mathematics 70.545F1 (MAT5131)

Ordinary Differential Equations

Existence and uniqueness theorems, boundary value problems, qualitative theory.

Prerequisite: Mathematics 70.308 or permission of the department.

• Mathematics 70.546F1 (MAT5133)

Introduction to Partial Differential Equations

First order linear, quasi-linear, and nonlinear equations; second order equations in two or more variables; systems of equations; the wave equation; Laplace and Poisson equations; Dirichlet and Neumann problems; Green's functions.

Prerequisites: Mathematics 70.302, or 70.307 and 70.308, or permission of the department.

• Mathematics 70.547W1 (MAT5134)

Topics in Partial Differential Equations

Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical co-ordinates.

Prerequisite: Mathematics 70.546 or permission of the department.

• Mathematics 70.550F1 (MAT5177)

Multivariate Normal Theory

Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.

Prerequisite: Mathematics 70.350.

- Mathematics 70.551W1 (MAT5191)

Statistical Inference

Sufficient statistics, simple and composite hypotheses, most powerful and similar region tests, distribution-free tests, confidence intervals, goodness-of-fit and likelihood ratio tests, large sample theory, Bayesian and likelihood methods, sequential tests.

Prerequisite: Mathematics 70.450 or permission of the department.

- Mathematics 70.552W1 (MAT5192)

Sampling Theory and Methods

Unequal probability sampling with and without replacement; unified theory for standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; nonresponse; measurement errors; related topics.

Prerequisite: Mathematics 70.452 or permission of the department.

- Mathematics 70.553F1 (MAT5193)

Linear Models

Theory of non full rank linear models: estimable functions, best linear unbiased estimators, hypothesis testing, confidence regions; multi-way classifications; analysis of covariance; variance component models: maximum likelihood estimation, Minque, Anova methods; miscellaneous topics.

Prerequisite: Mathematics 70.450 or permission of the department.

- Mathematics 70.554F1 (MAT5194)

Stochastic Processes and Time Series Analysis

Stationary stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.

Prerequisite: Mathematics 70.451 or permission of the department.

- Mathematics 70.555W1 (MAT5195)

Design of Experiments

Overview of linear model theory; orthogonality; randomized block and split plot designs; latin square designs; randomization theory; incomplete block designs; factorial experiments: confounding and fractional replication; response surface methodology. Miscellaneous topics.

Prerequisites: Mathematics 70.355 and 70.450 or permission of the department.

- Mathematics 70.556W1 (MAT5175)

Robust Statistical Inference

Nonparametric tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-method, L-estimators. Influence function. Adaptive procedures.

Prerequisite: Mathematics 70.450 or permission of the department.

- Mathematics 70.557W1 (MAT5176)

Advanced Statistical Inference

Pure significance tests; uniformly most powerful unbiased and invariant tests; asymptotic comparison of tests; confidence intervals; large-sample theory of likelihood ratio and chi-square tests; likelihood inference; Bayesian inference and topics such as empirical Bayes inference; fiducial and structural methods; resampling methods.

Prerequisite: Mathematics 70.457 or 70.551 or permission of the department.

- Mathematics 70.558F1 (MAT5172)

Topics in Stochastic Processes

Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures and infinite particle systems, advanced topics in modelling; population models, etc.

Prerequisites: Mathematics 70.356 and 70.451, or permission of the department.

- Mathematics 70.559F1 (MAT5196)

Multivariate Analysis

Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.

Prerequisite: Mathematics 70.450 or permission of the department.

- Mathematics 70.561F1 (MAT5197)

Stochastic Optimization

Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, sequential inference problems, optimal stopping, analysis and solution of deterministic and stochastic modelling problems in the physical, social and life sciences. Students will present a paper on applications of particular interest to them.

Prerequisite: Mathematics 70.356 or permission of the department.

- Mathematics 70.562F1 (MAT5317)

Analysis of Categorical Data

Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables and log-linear models; tests of symmetry and marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins and logistic models with binary response; measures of association and agreement; applications in biological, social and medical sciences.

Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the department.

- Mathematics 70.563W1 (MAT5318)

Reliability and Survival Analysis

Types of censored data; nonparametric estimation of survival function; graphical procedures for model iden-

tification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associated statistical inference; rank test with censored data; engineering, medical and biological sciences applications.

Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the department.

- Mathematics 70.565F1 (MAT5165)

Theory of Automata

Algebraic structure of sequential machines, decomposition of machines; finite automata, formal languages; complexity.

Prerequisite: Mathematics 70.210 or permission of the department.

- Mathematics 70.567F1 (MAT5324)

Game Theory

Two-person zero-sum games; infinite games; multi-stage games; differential games; utility theory; two-person general-sum games; bargaining problem; n -person games; games with a continuum of players.

Prerequisite: Mathematics 70.301 or permission of the department.

- Mathematics 70.569F1 (MAT5301)

Topics in Combinatorial Mathematics

Prerequisite: Permission of the department.

- Mathematics 70.571W1 (MAT5198)

Stochastic Models

Markov systems, stochastic networks, queueing networks, spatial processes, approximation methods in stochastic processes and queueing theory. Applications to the modelling and analysis of computer-communications systems and other distributed networks.

Prerequisite: Mathematics 70.356 or permission of the department.

- Mathematics 70.578F1 (MAT5170)

Probability Theory I

Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables.

Prerequisites: Mathematics 70.301, 70.302 and 70.350 or permission of the department.

- Mathematics 70.579W1 (MAT5171)

Probability Theory II

Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectation, basic properties and convergence theorems for martingales, introduction to Brownian motion.

Prerequisite: Mathematics 70.578 (MAT5170) or permission of the department.

- Mathematics 70.581F1 (MAT5303)

Linear Optimization

Linear programming problems; simplex method, upper bounded variables, free variables; duality; post-optimality analysis; linear programs having special structures; integer programming problems; unimodularity; knapsack problem.

Prerequisite: course in linear algebra and permission of the department.

- Mathematics 70.582F1 (MAT5325)

Introduction to Information and Systems Science

An introduction to the process of applying computers in problem-solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queueing systems, optimization.

(Also offered as Engineering 94.582, Computer Science 95.582 and Information and Systems Science 93.582)

- Mathematics 70.583W1 (MAT5304)

Nonlinear Optimization

Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions, duality; quadratic programming; geometric programming; separable programming; integer nonlinear programming; pseudo-Boolean programming; dynamic programming.

Prerequisite: Permission of the department.

- Mathematics 70.584F1, W1, S1 (MAT5307)

Topics in Operations Research

- Mathematics 70.585F1, W1, S1 (MAT5308)

Topics in Algorithm Design

- Mathematics 70.586F1 (MAT5180)

Numerical Analysis

Error analysis for fixed and floating point arithmetic; systems of linear equations; eigen-value problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.

Prerequisite: Permission of the department.

- Mathematics 70/95.587F1 (MAT5167)

Formal Language and Syntax Analysis

Computability, unsolvable and NP-hard problems. Formal languages, classes of language automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k). Syntax directed translation.

Prerequisites: Mathematics 70.565 or 70.485 or Computer Science 95.302, or permission of the department.

- Mathematics 70.588W1 (MAT5305)

Combinatorial Optimization

Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs.

Prerequisite: Permission of the department.

- Mathematics 70.589W1 (MAT5306)

Combinatorial Optimization

Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows with gains. Bottleneck problems. Matroid optimization. Enumerative and heuristic algorithms for the Travelling Salesman and other "hard" problems.

Prerequisite: Mathematics 70.588.

- Mathematics 70.590F1, W1, S1 (MAT5990)

Seminar

- Mathematics 70.591F1, W1, S1 (MAT5991)

Directed Studies

- Mathematics 70.593F1, W1, S1

Project

This course is intended for students registered in the M.Sc. degree program in Information and Systems Science and the M.C.S. program. Students pursuing the non-thesis option will conduct a study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

- Mathematics 70.594F1, W1, S1

Statistical Internship

This course is project-oriented and affords students the opportunity to undertake statistical research and data analysis projects either within the Statistical Consulting Centre or as a co-operative project with governmental or industrial sponsors. In addition to project work, seminars on related topics will be conducted. Practical data analysis and consulting skills will be emphasized. The grade assigned in this course will be based upon oral and written presentation of analysis results and will be determined in consultation with the faculty advisor and the sponsor.

Permission of the institute is required for registration in this course.

- Mathematics 70/94/95.595F4, W4, S4

M.C.S. Thesis

- Mathematics 70/94.598F3, W3, S3

M.Sc. Thesis in Information and Systems Science

- Mathematics 70.599F2, W2, S2

M.Sc. Thesis

- Mathematics 70.602W1 (MAT5309)

Harmonic Analysis on Groups

Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.

- Mathematics 70.608F1, W1, S1 (MAT5326)

Topics in Analysis

- Mathematics 70.611F1, W1, S1 (MAT5327)

Topics in Algebra

- Mathematics 70.614W1 (MAT5158)

Lie Groups

Matrix groups: one-parameter groups, exponential map, Campbell-Hausdorff formula, Lie algebra of a matrix group, integration on matrix groups. Abstract Lie groups.

Prerequisite: Mathematics 70.507 and 50.517 or permission of the department.

- Mathematics 70.621F1, W1, S1 (MAT5312)

Topics in Topology

- Mathematics 70.657F1, W1, S1 (MAT5313)

Topics in Probability and Statistics

- Mathematics 70.658F1, W1, S1 (MAT5314)

Topics in Probability and Statistics

- Mathematics 70.690F1, W1, S1 (MAT6990)

Seminar

- Mathematics 70.691F1, W1, S1 (MAT6991)

Directed Studies

- Mathematics 70.699F, W, S

Ph.D. Thesis

Ottawa-Carleton Centre for Physics

Herzberg Bldg. 316
788-4375

The Centre

Director of the Centre: P.J.S. Watson
Associate Director: Brian Hird

Students wishing to pursue studies in physics at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Physics of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations and student admissions.

Students are admitted for graduate work under the general regulations of the centre, which include criteria related to academic performance, research experience and referees' appraisals. The choice of program and/or research project and supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

The areas of physics available for programs leading to the M.Sc. or Ph.D. degree are indicated by the research interests of the members of the centre listed below. An M.Sc. by course work, with no thesis, is also possible.

Requests for information and completed applications should be sent to the director of the centre.

Members of the Centre

A.J. Alcock, *Laser and Plasma Physics*
J.C. Armitage, *High Energy Physics, Instrumentation*
R.K. Carnegie, *Experimental High Energy Physics*
A.L. Carter, *Intermediate Energy Physics, Instrumentation*
R.L. Clarke, *Medical Physics*
L.A. Copley, *Theoretical Particle Physics*
Marie D'Iorio, *Condensed Matter*
K.W. Edwards, *Experimental High Energy Physics*
P.G. Estabrooks, *Experimental High Energy Physics*
Emery Fortin, *Semiconductor Physics*
L. Gerig, *Medical Physics*
H.R. Glyde, *Condensed Matter Theory*
J.E. Hardy, *Field Theory*
C.K. Hargrove, *Experimental High Energy Physics*
Jacques Hebert, *High Energy Physics*
R.J. Hemingway, *Experimental High Energy Physics*
Gerhard Herzberg, *Molecular Spectroscopy*
Brian Hird, *Atomic Collisions*
R.J.W. Hodgson, *Theoretical Nuclear Physics*
Patricia Kalyniak, *Theoretical Physics*
Dan Kessler, *Astrophysics*
Gilles Lamarche, *Low Temperature Physics*
M.A.R. LeBlanc, *Superconductivity*

B.A. Logan, *Nuclear Physics*
Armen Manoogian, *Electron Spin Resonance*
M. Marchand, *Condensed Matter Physics*
H.J.A.F. Mes, *Experimental High Energy Physics*
Michael Ogg, *Experimental High Energy Physics*
P. Piercy, *Condensed Matter Physics*
P. Raaphorst, *Medical Physics*
Lazer Resnick, *Theoretical Particle Physics*
D.W. Rogers, *Medical Physics*
W.J. Romo, *Theoretical Nuclear and Particle Physics*
Alain Roth, *Condensed Matter*
A.K.S. Song, *Theoretical Studies in Solid State*
M.K. Sundaresan, *Theoretical Particle Physics*
Roger Taylor, *Condensed Matter Theory*
Y.P. Varshni, *Theoretical Solid State, Astrophysics*
P.J.S. Watson, *Theoretical Particle Physics*
Digby Williams, *Condensed Matter*
James Webb, *Condensed Matter*
J.C. Woolley, *Semiconductor Physics*

Master of Science

An honours B.Sc. in Physics or a closely related field at a standard acceptable to the two universities is normally required for admission into the M.Sc. program. The admissions committee may require students to take an orientation examination during the first weeks of residence. The results of this examination may indicate the need for a student to register in undergraduate courses to fill gaps in his/her knowledge.

Program Requirements

Normally the requirements for the M.Sc. degree will consist of:

- A minimum of one and one-half ($1\frac{1}{2}$) full-course equivalents (9 term contact hours) of which a minimum of one full course (6 term contact hours) must be at the graduate level. Candidates admitted with more than these minimum requirements may be permitted to credit towards the degree a maximum of one full-course credit at the senior undergraduate level. The above maximum does not apply to qualifying-year students
 - A thesis which will be defended at an oral examination
 - Participation in the seminar series of the centre.
- In special cases, the requirements may also be met by taking five full courses and no thesis. In this case, one of the courses must be the selected topics course; a comprehensive examination and participation in the seminar series will also be required.

Doctor of Philosophy

Admission Requirements

An M.Sc. in Physics or a closely related field, is normally required for admission into the Ph.D. program. Students who have been admitted to the M.Sc. program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

In exceptional cases, an outstanding student who has completed the honours B.Sc. will also be considered.

Program Requirements (from M.Sc.)

The normal requirements for the Ph.D. degree (after M.Sc.) are:

- A minimum of two full-course equivalents at the graduate level (12 term contact hours)
- A comprehensive examination with emphasis on areas chosen by the candidate's advisory committee in consultation with the candidate (an oral examination and/or a written examination normally at the end of the first full year of study)
- A thesis which will be defended at an oral examination. The examining board for all these will include members of the centre from both Departments of Physics. The external examiner of the thesis will be external to both Departments of Physics
- Participation in the seminar series of the centre.

Residence Requirements

For the M.Sc. degree

- at least one year of full-time study (or the equivalent)

For the Ph.D. degree (from B.Sc.)

- at least three years of full-time study (or the equivalent)

For the Ph.D. degree (from M.Sc.)

- at least two years of full-time study (or the equivalent).

Graduate Courses*

Some of the following are regarded as the core courses and are taught either at Carleton University or at the

*All courses offered are half-course credits.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

University of Ottawa. The more specialized courses are *only* taught at the indicated campus. Most of the core courses will be offered each year, but only a selection of the others. If enrolment is small, a course may be given as a reading course. In addition to the formal prerequisites for a course, any course requires permission of the department.

The following courses may be offered either at Carleton University or the University of Ottawa.

• Physics 75.502W1 (PHY5340)

Application of Advanced Computational Methods in Physics

Brief introduction to the number representation on a digital computer. Applications of methods of numerical optimization to calculate energy eigenvalues in quantum mechanics. Techniques of fitting experimental data. Numerical integrations and their application to distribution functions in statistical mechanics and special functions in theoretical physics. Numerical solutions of differential equations in physics.

• Physics 75.561F1 (PHY5966)

Experimental Techniques of Nuclear and Elementary Particle Physics

The interaction of radiation and high energy particles with matter; experimental methods of detection and acceleration of particles; use of relativistic kinematics; counting statistics.

Prerequisites: Physics 75.437 and 75.477.

• Physics 75.562W1 (PHY5967)

Physics of Elementary Particles

Properties of leptons, quarks, and hadrons. The fundamental interactions. Conservation laws; invariance principles and quantum numbers. Resonances observed in hadron-hadron interactions. Three body phase space. Dalitz plot. Quark model of hadrons, mass formulae. Weak interactions; parity violation, decay of neutral kaons; CP violation; Cabibbo theory.

Prerequisite: Physics 75.477.

• Physics 75.571F1 (PHY5170)

Intermediate Quantum Mechanics with Applications Angular momentum and rotation operations; Wigner and Racah coefficients; several and many electron problem in atoms; variational and Hartree-Fock formalism; introduction to second quantized field theory; scattering theory.

Prerequisites: Physics 75.477 and 75.478.

• Physics 75.581F1 (PHY5140)

Methods of Theoretical Physics I

This course and Physics 75.582 are designed for students who wish to acquire a wide background of mathematical techniques. Topics can include complex variables, evaluation of integrals, approximation techniques, dispersion relations, Padé approximants, boundary value problems, Green's functions, integral equations, and group theory.

The following courses are offered only at Carleton University.

• **Physics 75.511F1 (PHY8111)**

Classical Mechanics and Theory of Fields

Hamilton's principle; conservation laws; canonical transformations; Hamilton-Jacobi theory; Lagrangian formulation of classical field theory.

• **Physics 75.522W1 (PHY8122)**

Molecular Spectroscopy

Spectra of simple molecules; brief survey of atomic spectroscopy; rotations and vibrations of diatomic and polyatomic molecules and the methods of obtaining information about the geometrical structure of the molecule, and the forces acting between the constituent particles from the observed rotation and vibration spectra; electronic structure of molecules as derived from a study of electronic spectra based mainly on molecular orbital theory. The description will be from the point of view of the experimentalist rather than the theorist.

(Also offered as Chemistry 65.509)

• **Physics 75.525 (PHY5112)**

Physics of Diagnostic Medical Imaging

An introduction to the application of physics to diagnostic medical imaging. The principles of transmission x-ray imaging, computerized tomography, nuclear medicine, magnetic resonance imaging, and ultrasound (both imaging and doppler) are covered. Physical descriptors of image quality, including contrast, resolution, signal-to-noise ratio, and modulation transfer function, are introduced. Graduate students enrolling in this course will be expected to complete a project on a subject chosen in consultation with the teaching staff.

• **Physics 75.532W1 (PHY8132)**

Classical Electrodynamics

Covariant formulation of electrodynamics; Lenard-Wiechert potentials; radiation reaction; plasma physics; dispersion relations.

Prerequisite: Physics 75.437 or equivalent.

• **Physics 75.553F1 (PHY8153)**

Reactor Physics I

Brief review of orthogonal co-ordinate systems; divergence, Laplacian, etc., in various co-ordinate systems; continuity equation; flow equations (heat, current, neutrons); diffusion of thermal neutrons (collisional energy transfer, scattering probability, statistical energy degradation); Fermi age-velocity theory; fast neutron flow equation; thermal multiplication pile; criticality criteria; solutions of flow and continuity equations; heat flow (various geometries and boundary conditions), neutron flow (moderation by graphite block).

Prerequisites: Physics 75.381 and 75.386.

• **Physics 75.564W1 (PHY8164)**

Intermediate Nuclear Physics

Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models; single particle shell model, shell model with interactions, pairing, quasi-particles, collective models, deformed shell model. Scattering theory; effective range theory, partial wave analysis, phase shifts. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation; multipole fields, transition rates, selection rules, internal conversion.

Prerequisite: Physics 75.468 or equivalent.

• **Physics 75.572W1 (PHY8172)**

Relativistic Quantum Mechanics

Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electrodynamics without second quantization. Gauge theories and the standard model.

Prerequisite: Physics 75.571.

• **Physics 75.582W1 (PHY5141)**

Methods of Theoretical Physics II

This course complements 75.581. Topics include group theory, discussion of SU_2 , SU_3 , and other symmetry groups. Lorentz group. Integral equations and eigenvalue problems.

• **Physics 75.590T2 (PHY8290)**

Selected Topics in Physics (M.Sc.)

A student may, with the permission of the department, take more than one selected topic, in which case each full course in Physics 75.590 will be counted for credit. Not more than one selected topic may be taken for credit in any one academic year.

• **Physics 75.591F1, W1, S1 (PHY8191)**

Selected Topics in Physics (M.Sc.)

• **Physics 75.599F, W, S (PHY8199)**

M.Sc. Thesis

• **Physics 75.661 (PHY8161)**

Particle Physics Phenomenology

This course covers much of the basic knowledge for both experimental and theoretical particle physics. Topics may include: accelerators, properties of detectors, low energy spectroscopy, standard model, tests of QCD and introduction to grand unified models.

Prerequisite: Physics 75.562 or equivalent.

• **Physics 75.662 (PHY8162)**

Advanced Topics in Particle Physics Phenomenology

This course will consist of a variety of seminars and short lecture courses, and will cover topics of immediate interest to the research program of the department.

Prerequisite: Permission of the department.

- Physics 75.671F1 (PHY8173)

Quantum Electrodynamics

Relativistic quantum field theory; second quantization of Bose and Fermi fields; reduction and LSZ formalism; perturbation expansion and proof of renormalizability of quantum electrodynamics; calculations of radiative corrections and applications.

Prerequisites: Physics 75.511, 75.532, 75.571 and 75.572.

- Physics 75.690T2 (PHY8490)

Selected Topics in Physics (Ph.D.)

- Physics 75.691F1, W1 (PHY8391)

Selected Topics in Physics (Ph.D.)

- Physics 75.699F, W, S

Ph.D. Thesis

The following courses, offered at the University of Ottawa, may be taken for credit by Carleton students.

- Physics 74.541F1 (PHY5100)

Solid State Physics I

Periodic structures. Lattice waves. Electron states. Static properties of solids. Electron-electron interaction. Dynamics of electrons. Transport properties. Optical properties.

- Physics 74.542 (PHY5110)

Solid State Physics II

Elements of group theory. Band structure, tight binding and other approximations, Hartree-Fock theory. Measuring the Fermi surface. Boltzmann equation and semiconductors. Diamagnetism, paramagnetism and magnetic ordering. Superconductivity.

- Physics 74.543 (PHY5151)

Type I and II Superconductors

Flux flow and flux cutting phenomena. Clem general critical state model. Flux quantization, Abrikosov vortex model and Ginzburg-Landau theory. Superconducting tunneling junctions (Giaever and Josephson types).

Prerequisite: PHY4370.

- Physics 74.544 (PHY5180)

Symmetry Properties of the Solid State

Crystallographic symmetry elements. Point groups and representation. Space groups. Properties of crystalline materials. Effect of ordering. Application to semiconductors.

- Physics 74.545 (PHY5181)

Metallurgical Physics

Equilibrium diagrams and phase changes — phase rule and free energy. Superlattices and order-disorder effects. Methods of crystal growth. Interpretation of X-ray photographs, etc. Structure determinations.

- Physics 74.546 (PHY5184)

Transport Properties of Solids

Electrical and thermal conduction in metals. Selected topics.

Prerequisite: PHY4385 or equivalent.

- Physics 74.547 (PHY5380)

Semiconductor Physics I

Brillouin zones and band theory. E-k diagram, effective mass tensors, etc. Electrical properties of semiconductors. Conduction, hall effect, magneto-resistance. Scattering processes. Multivalley models and non-parabolic bands.

Prerequisite: PHY4380 or equivalent.

- Physics 74.548 (PHY5381, PHY5781)

Semiconductor Physics II — Optical Properties

Optical constants and dispersion theory. Optical absorption, reflection and band structure. Absorption at band edge and excitons. Lattice, defect and free carrier absorption. Magneto-optics. Photo-electronic properties, luminescence, detector theory. Experimental methods.

Prerequisite: PHY4380 or equivalent.

- Physics 74.549 (PHY5951)

Low Temperature Physics II

Helium 3 and Helium 4 cryostats. Dilution refrigerators. Theory and techniques of adiabatic demagnetization. Thermometry at low temperatures. Problems of thermal equilibrium and of thermal isolation. Properties of matter at very low temperature.

Prerequisite: PHY4355 or equivalent.

- Physics 74.551 (PHY5125)

Charged Particle Dynamics

A course on the acceleration, transport and focussing of charged particles in vacuum using electric and magnetic fields. Beam optics. Phase space of an assembly of particles. Applications to experimental systems.

- Physics 74.552 (PHY5162)

Applications of Nuclear Physics in Other Fields in Physics

A selection of topics from: Mossbauer effect, fundamental conservation laws, astrophysics, optical spectroscopy.

Prerequisite: PHY4360 or equivalent.

- Physics 74.563 (PHY5310)

Ion Collisions in Solids

Energy loss of energetic particles in passing through solids. Stopping cross sections. The influence of the crystal lattice on nuclear stopping. Crystal lattice effects at high energies. Channelling and blocking. The collision cascade. Charge states of fast ions in solids from thin foil and X-ray measurements.

- Physics 74.565 (PHY5350)

Atomic Structure

A survey of the notation and conventions used to describe the states of isolated single atoms and diatomic molecules.

- Physics 74.566 (PHY5365)

Ion Collisions in Gases

Atomic cross sections. Heavy particle collision theory. Born-Oppenheimer approximation. Adiabatic approxi-

mation. Molecular orbit model. Lichten-Fano model. Nonadiabatic processes. Survey of experimental status. Inner shell vacancy production. Nonviolent inelastic collisions. High energy collision theory. Negative ion detachment.

Prerequisite: PHY5350 or equivalent.

- Physics 74.567 (PHY5965)

Cosmic Rays and Nuclear Interaction at Very High Energies

Interaction of charged particles with matter. Abundance of elements in the cosmic radiation. Analysis of particle cascades produced in interactions of energy greater than 1000 GeV.

Prerequisite: PHY4360 or equivalent.

- Physics 74.573 (PHY6170)

Quantum Mechanics IV

Systems of identical particles. Scattering theory. Relativistic Quantum Mechanics. Applications in nuclear physics.

Prerequisite: PHY5170 or equivalent.

- Physics 74.641 (PHY6150)

Superconductivity II

Flux flow phenomena, superelectron tunneling, Josephson D.C. and A.C. effects, Bean-Kim-Anderson critical state model.

Prerequisite: PHY4370 or equivalent.

- Physics 74.642 (PHY6180)

Symmetry Properties of the Solid State II

Introduction to group theory. Group representations. Abelian groups, irreducible representation, etc. Application to crystallographic point groups. Reciprocal lattice and Brillouin zones. Wave vector group. Spin-orbit coupling.

Prerequisite: PHY5180 or equivalent.

- Physics 74.643 (PHY6340)

Statistical Mechanics

Boltzmann's equation. Electrical conduction in semi-conductors. Relaxation time. Magneto-resistance. Scattering mechanisms; deformation potential, impurity, piezo-electric, optical polar, electron-hole. Thermal conduction in semi-conductors.

Prerequisite: PHY5380.

- Physics 74.644 (PHY6920)

Advanced Magnetism II

Selected topics in nuclear and electronic magnetic resonances.

Prerequisite: PHY5920.

- Physics 74.645 (PHY7181)

Some Applications of Crystal Field Theory

Effect of crystalline electric field and magnetic interactions on magnetic centres in solids. Energy level splittings. Spin Hamiltonian formulation. Paramagnetic resonance. Magnetic susceptibility. Optical transitions, etc.

Prerequisite: PHY6180.

- Physics 74.661 (PHY6160)

Nuclear Structure

Static nuclear properties. Current nuclear models. Methods of calculating energies and properties of nuclear levels. Nuclear matter.

Prerequisites: PHY4360 and PHY5170.

- Physics 74.672 (PHY6171)

Quantum Mechanics V

Topics in advanced quantum mechanics selected from: second quantization diagram techniques. Green function techniques, formal theory of scattering.

Prerequisite: PHY5170 or equivalent.

School of Computer Science

Herzberg Bldg. 542
788-4333

The School

Director of the School: J.R. Pugh

Supervisor of Graduate Studies: J.-R. Sack

The School of Computer Science offers a Master of Computer Science degree through the Ottawa-Carleton Institute for Computer Science. The Institute is jointly administered by the School and the Department of Computer Science at the University of Ottawa. For further information, including admission and program requirements, see page 12.

A program leading to the M.Sc. in Information and Systems Science is offered in cooperation with the Department of Mathematics and Statistics and the Department of Systems and Computer Engineering, see page 142.

The research expertise of School faculty is concentrated in the following areas:

- *Algorithms and Complexity*

Computational geometry and algebra, combinatorial optimization, distributed and parallel algorithms, multi-dimensional data structures, stochastic automata, graph theory, partial orders.

- *Intelligent Systems*

Expert systems, knowledge acquisition tools, knowledge based assistants, connectionism and neural networks, natural language understanding, learning and adaptability, robotics, pattern recognition.

- *Object-Oriented Systems*

Visual programming, filing systems, databases, user interfaces, simulation, animation, software engineering, office automation.

- *Distributed Systems*

Operating systems, databases, systolic architectures, tools for performance studies, distributed programming languages, parallel computing, communication complexity, networks.

In addition to its undergraduate laboratories the School maintains three research laboratories, containing PC-AT clones, MacII's, Tektronix and SUN workstations, laser printers and a Symbolic 3600 Lisp machine all integrated via a department and campus area network.

Graduate Courses

The complete list of courses available through the Ottawa-Carleton Institute for Computer Science is given on page 160. The following courses are offered by the School of Computer Science.*

- Computer Science 95.501F1 (CSI5113)

Foundations of Programming Languages

This course will study current topics in the theory and practice of programming language design and implementation. Different styles of languages: imperative, applicative, logic, constraints, object-centred, data-flow, production systems. Abstraction mechanisms; primitives; extensibility; procedural v. declarative semantics; interpretation; compilation; program transformations.

Prerequisite: Computer Science 95.207 or the equivalent.

- Computer Science 95.502W1 (CSI5119)

User Interface Facilities

This project oriented course is concerned with the concepts, methodologies and algorithms for the specification, design and implementation of visual User Interface Facilities (UIF). The principal focus is on the software engineering of user interfaces. UIF applications in computer aided instruction, computer-aided design and visual programming are used to illustrate both general and special purpose user interfaces. Current commercial and research approaches are studied from the perspective of the user, the application designer and the systems programmer. The alternative programming metaphors of control flow, data flow, objects and constraints are introduced and their importance is discussed in the context of integrated user interface.

Prerequisite: Computer Science 95.501 or equivalent.

- Computer Science 95.503F1 (CSI5308)

Principles of Distributed Computing

Formal models; semantics of distributed computations; theoretical issues in design of distributed algorithms; computational complexity; reducibility and equivalence of distributed problems. Related topics:

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

systolic systems and computations, oligarchical systems and control mechanisms.

Prerequisite: Permission of the school.

- Computer Science 95.504W1 (CSI5305)

Topics in Arithmetic Complexity

Most scientific calculations rest on the basic arithmetic operations carried out on numbers, polynomials, and matrices. The course begins by studying the complexity of these operations. It proceeds to examine the related problem of finding the factors of an integer or polynomial, and it discusses the applications of this problem to cryptography and coding theory. The course concludes with a selection of other fundamental problems, such as polynomial evaluation, and the exploitation of parallel hardware.

Prerequisite: Computer Science 95.484 or equivalent.

- Computer Science 95.505F1 (CSI5390)

Automata Models of Learning Systems

This course will introduce the students to computerized adaptive learning. Learning models in mathematical psychology will be discussed. Mathematical tools such as Markov chains and the solution of difference equations will be reviewed. The heart of the course will involve deterministic and stochastic learning automata, variable structure stochastic automata, operation in random environments, norms of learning, linear and nonlinear learning schemes, convergence problems, and discretized automata with ergodic and non-ergodic properties. Applications of learning automata in file allocation, game playing, path finding, optimization and decision making will be discussed.

Prerequisite: Mathematics 70.260 or 70.350, or Engineering 94.553, or equivalent.

- Computer Science 95.506W1 (CSI5306)

Natural Language Understanding

This course will introduce the students to current research in natural language processing. The emphasis of the course will be on semantic and pragmatic rather than syntactic issues and on analyzing connected discourse rather than single sentences. Several existing natural language analyzers and their applications to text analysis, CAI, knowledge acquisition, data base retrieval and intelligent assistants will be described in detail. Topics will include: meaning representation; representation of pragmatic information and speech act theory; flexible parsing; determination of focus and reference; task-oriented dialog systems; dynamic memory issues. Students will be required to implement a prototype natural language analyzer.

Prerequisite: Computer Science 95.407 or 95.501, or equivalent.

- Computer Science 94/95.507F1 (CSI5307)

Expert Systems

This course will include: survey of some landmark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate

reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.

Prerequisite: Computer Science 95.407 or 95.501 or permission of the school.

- Computer Science 95.508W1 (CSI5164)

Computational Geometry

This course will study the design and analysis of algorithms for solving geometrical problems. These algorithms have applications in such areas as computer graphics, pattern recognition and robotics. Topics will include: visibility problems, hidden line removal, classes of polygons, testing polygons for structural properties, convex hull problems, movability of objects through a set of obstacles, point inclusion in polygons, decomposition of objects into 'meaningful' components, triangulation and guard problems.

Prerequisite: Computer Science 95.384 or equivalent.

- Computer Science 95.509F1 (CSI5141)

Associative Structures and Database Machines

The course covers techniques for the storage, retrieval, and processing of information on mass storage systems. Specialized storage structures: pictorial and geometric databases; storage and retrieval of spatial objects; design of information retrieval systems. Organization of multidimensional tree structures: K-D trees; K-D-B trees; quad trees. Multidimensional dynamic hashing schemes; PATRICIA and compressed tries; associative processors; database machine architecture, theory and software; document retrieval systems.

Prerequisites: Computer Science 95.305 and 95.384, or equivalent.

- Computer Science 95.510W1 (CSI5180)

Topics in Artificial Intelligence

A programming oriented introduction to selected topics in Artificial Intelligence (A.I.). Topics for consideration include: A.I. programming techniques, pattern matching systems, natural language systems, rule based systems, constraint systems, learning systems, and cognitive systems. Assignments will be both (a) programming oriented requiring implementations and/or extensions of prototypes in Lisp and/or Prolog and (b) research oriented requiring readings of special topics in current A.I. journals.

Prerequisite: Computer Science 95.501 or equivalent.

- Computer Science 95.511F1 (CSI5311)

Distributed Databases and Transaction Processing Systems

The course addresses the principles involved in the design and implementation of distributed databases and transaction processing systems. Topics covered include: distributed system architectures and models; distributed file systems; atomicity of distributed transaction; design of stable storage; synchronization mechanisms; concurrency control algorithms in distributed systems. Further topics cover issues of: multi-

ple copy updates; applications and protocols; error recovery; reliability and protection in distributed systems.

Prerequisites: Computer Science 95.305, 95.401, and 95.403 or equivalent.

- Computer Science 95.512W1 (CSI5132)

Distributed Operating Systems

A course emphasizing the design issues of advanced multiprocessor distributed operating systems: multiprocessor system architectures; the process model; the object model; synchronization and message passing primitives; memory architectures and management; distributed filesystems; protection and security; distributed concurrency control; deadlock and recovery; remote tasking; dynamic reconfiguration; performance measurement, modelling, and system tuning.

Prerequisite: Computer Science 95.300 or equivalent.

- Computer Science 95.513F1 (CSI5131)

Cryptography

Classical cryptosystems: substitution ciphers, homophonic ciphers, product ciphers, DES. Public key schemes: RSA, Knapsack codes. Digital signatures, fair communication protocols, key management.

Prerequisite: Permission of the School

- Computer Science 95.514W1 (CSI5134)

Object-Oriented Systems

An examination of advanced topics and current research in object-oriented programming systems, languages, and applications. Potential topics include: object-oriented design; comparative evaluation of object-oriented systems; compiled vs. interpretive systems; manifest vs. latent types; prototypes vs. classes; inheritance mechanisms; persistent objects; concurrency; distributed objects; reflective architectures.

Prerequisite: Computer Science 95.501 or equivalent.

- Computer Science 95.515W1 (CSI5132)

Parallel Processing Systems

The aim of this course is to provide an introduction to the issues involved in designing and using parallel processing systems. Topics will be selected from the following: taxonomy and applications of parallel systems; SIMD systems; multiprocessor systems; multi-computer systems; computation vs. communication issues in parallel processing; scheduling in parallel systems; spinning vs. blocking; interconnection networks; hot-spot contention.

Prerequisite: Permission of the School.

- Computer Science 95.573F1 (CSI5163)

Algorithm Analysis and Design

Topics of current interest in the analysis and design of sequential and parallel algorithms for non-numerical, algebraic and graph computations. Lower bounds on efficiency of algorithms. Complexity classes.

Prerequisite: Permission of the School.

- Computer Science 95.574W1 (CSI5131)

Parallel Algorithms and their VLSI Implementation
Introduction: models of computation, levels of parallelism, performance measures for parallel algorithms, need for parallel algorithms. Parallel algorithms: techniques in matrix multiplication, solution of linear equations, transforms and differential equations, systolic arrays for the implementation of parallel algorithms in the areas of matrix arithmetic, transforms and relational database operations. VLSI implementations: VLSI and parallel computing structures, mapping of high-level computations into VLSI structures.
Prerequisite: 95.484 or equivalent.

- Computer Science 95.582W1

Introduction to Information and Systems Science

An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queueing systems, optimization.
(Also listed as Mathematics 70.582, Engineering 94.582, Information and Systems Science 93.582.)

- Computer Science 95/70.587F1 (CSI5104)

Formal Language and Syntax Analysis

Computability, unsolvable and NP-hard problems. Formal languages, classes of languages, automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k); syntax directed translation.
Prerequisite: Computer Science 95.302 or Mathematics 70.485 or 70.565, or equivalent.

- Computer Science 95.590F1, W1, S1 (CSI5140)

Selected Topics in Computer Science

Selected topics, not covered by other graduate courses, will be offered. Details will be available at the time of registration.

- Computer Science 95.591F1, W1, S1 (CSI5100)

Directed Studies

A course of independent study under the supervision of a member of the School of Computer Science.

- Computer Science 95.592F1, W1, S1 (CSI5100)

Project

- Computer Science 70/94/95.595F, W, S (CSI7999)

M.C.S. Thesis

- Computer Science 70/93/94/95.598F, W, S
M.Sc. Thesis in Information and Systems Science

Ottawa-Carleton Institute for Computer Science

Herzberg Bldg. 542
788-4333

The Institute

Director of the Institute: J.-R. Sack

Associate Director of the Institute: L.G. Birta

Students who wish to pursue studies in computer science leading to a Master of Computer Science (M.C.S.) degree can do so in a joint program offered by the School of Computer Science at Carleton University and the Department of Computer Science at the University of Ottawa under the auspices of the Ottawa-Carleton Institute for Computer Science. The Institute is responsible for supervising the program and for providing a framework for interaction between the two departments at the research level. In addition to the faculty members from the two computer science departments the Institute also has members with computer science expertise from other departments.

Requests for information, and completed applications, should be sent to the Director or Associate Director of the Institute. A joint admissions committee examines all applications and assigns students to the most appropriate campus and supervisor.

Members of the Institute

The "home" department of each member is indicated by (CSI) for the Department of Computer Science, University of Ottawa, (ELG) for the Department of Electrical Engineering, University of Ottawa, (ADM) for Faculty of Administration, University of Ottawa, (SCS) for the School of Computer Science, Carleton University, (MAT) for the Department of Mathematics and Statistics, Carleton University, (SCE) for the Department of Systems and Computer Engineering, Carleton University.

M.D. Atkinson, SCS, *Complexity, algorithms, computational algebra*.

E.S. Bainbridge, CSI, *Automata theory, logic and databases*.

L.G. Birta, CSI, *Simulation, optimization, numerical algorithms*

B.A. Bowen, SCE, *Expert systems, systems design*

S. Boyd, CSI, *Optimization, combinatorics*

R.J.A. Buhr, SCE, *Software engineering, protocols, CAD of computer systems*

T.Y. Cheung, CSI, *Distributed computing, optimization, databases*

T.W. Chinneck, SCE, *Operations research, modelling and simulation methodology*

W.H. Cunningham, MAT, *Optimization, algorithms, graph theory*

S. Dandamudi, SCS, *Parallel and distributed systems, database systems, performance evaluation, computer architecture, operating systems*

N.W. Dawes, SCE, *Communication networks, Optimization*

F. Dehne, SCS, *Computational geometry, VLSI algorithms*

J.D. Dixon, MAT *Algorithms, algebra, number theory*

F. Fiala, SCS, *Optimization, combinatorics*

N. Georganas, ELG, *Computer communications, mobile radio*

M. Goldberg, ELG, *Image processing, pattern recognition*

G.M. Karam, SCE, *Logic Programming, office automation*

T. Kasvand, CSI, *Digital image processing, pattern recognition*

A.R. Kaye, SCE, *Expert systems, office automation*

M. Krieger, ELG, *Computer architecture*

W.R. LaLonde, SCS, *Programming languages, artificial intelligence*

L. Logrippo, CSI, *Software methodology, communications protocols*

S.A. Mahmoud, SCE, *Local area networks, communication protocols*

S.J. Matwin, CSI, *Programming languages, expert systems*

L.R. Morris, SCE, *Signal processing, speech analysis, graphics*

B.C. Mortimer, MAT, *Combinatorics, algorithms, group theory*

J. Neilson, SCS, *Computer architecture, distributed computing*

J. Oommen, SCS, *Automata, pattern recognition, image processing*

F. Oppacher, SCS, *Natural language processing, expert systems*

T.I. Oren, CSI, *Simulation, modelling*

E.J. Otoo, SCS, *CFTRIDatabases, algorithms*

B. Pagurek, SCE, *Queueing, Databases*

R.L. Probert, CSI, *Communications, expert systems*

J. Pugh, SCS, *Artificial intelligence, graphics, programming languages*

J. Raymond, CSI, *Computer architecture, graphics*

I. Reichstein, SCS, *Numerical applications, microcomputers*

I. Rival, CSI, *Combinatorics, optimization, algorithm*

J.-R. Sack, SCS, *Algorithms, computational geometry, graphics*

N. Santoro, SCS, *Algorithms, distributed and parallel computing*

P. Scott, CSI, *Logic, theoretical computer science, category theory*

J.B. Sidney, ADM, *Combinatorics, complexity, computational geometry*

D.R. Skuce, CSI, *Artificial intelligence, logic programming*

I. Stojmenovic, CSI, *Computational geometry, multiple-valued logics, parallel computing*
 S. Szpakowicz, CSI, *Logic programming, computational linguistics*
 D. Thomas, SCS, *Artificial intelligence, fifth generation machines*
 H. Ural, CSI, *Software reliability and testing, data communication protocols, applications of logic programming*
 J. Urrutia, CSI, *Algorithms, combinatorics, geometry and algorithms*
 R. Vaillancourt, CSI, *Numerical methods*
 G.M. White, CSI, *Networking, office automation*
 C.M. Woodside, SCE, *Performance modelling, distributed systems, queueing*

Master of Computer Science

Admission Requirements

Applicants should have an honours bachelor's degree in computer science or equivalent, with at least high honours standing. By *equivalent* is meant an honours degree in a program which includes at least six computer science full courses, two of which must be at the fourth-year level, as well as four full courses in mathematics, one of which must be at the third- or fourth-year level. These courses must include the topics indicated below:

Computer Science

Data structures/file management, operating systems, computer architecture, algorithm design and analysis, assembly language and two high-level languages

Mathematics

Calculus, linear algebra, algebraic structures or discrete mathematics, probability and statistics, numerical analysis

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Program Requirements

The program includes graduate study and research in four broad areas identified as follows:

- *Programming Systems and Languages*

Database systems, operating systems, software methodology, software translators, language design

- *Theory of Computing*

Analysis of algorithms, automata theory, formal languages, complexity, computability, logic and program schemata

- *Computer Applications*

Artificial intelligence, graphics, picture and signal processing, modelling and simulation, numerical analysis, optimization

- *Computer Systems*

Computer architecture, networks and distributed processing, computer communications, mini- and micro-computers

Within these areas, the program emphasizes problems of current practical significance and has close links to the scientific and industrial communities.

Normally, students in the program will be expected to complete a thesis; however, students who have substantial relevant work experience may be permitted to take the non-thesis option, which must include a graduate research project course. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.

Students in the thesis option will take six half-courses or equivalent in addition to their thesis work. Students in the non-thesis option will take 10 half-courses. The course selections must be approved by the student's academic adviser, and must include at least

- One half-course in programming systems and languages
- One half-course in the theory of computing
- One half-course in either computer applications or computer systems.

Both course and thesis work may be completed either by full-time or part-time study. A candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the institute.

Graduate Courses

The courses in the following list are offered by various departments indicated by the prefix of the course code as follows:

Carleton University

- 70. Department of Mathematics and Statistics
- 94. Department of Systems and Computer Engineering
- 95. School of Computer Science

University of Ottawa

- CSI Department of Computer Science
- ELG Department of Electrical Engineering
- MAT Department of Mathematics

Programming Systems and Languages

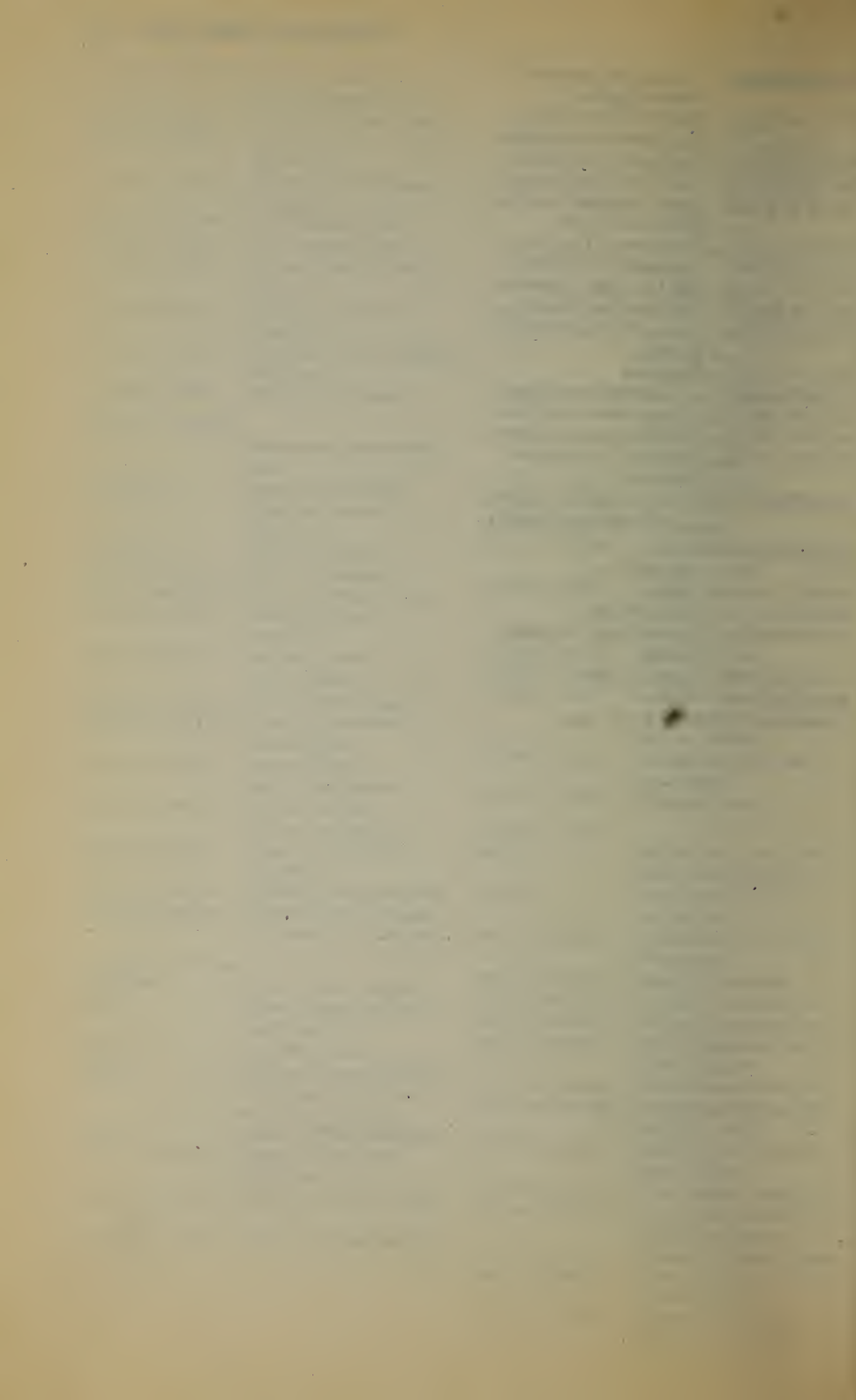
- 94.480 Software Engineering
- 95.404 Systems Software
- 95.490 Advanced Topics in Computer Science
- 94.531 (ELG6131) System Design with ADA

- 94.571 (CSI5117) Mini/Microcomputer Operating System Design
- 94.573 (CSI5115) Integrated Database Systems
- 94.579 (CSI5112) Advanced Topics in Software Engineering
- 95.501 (CSI5113) Foundations of Programming Languages
- 95.502 (CSI5119) User-Interface Facilities
- 95.514 (CSI5314) Object-oriented Systems
- CSI5111 (95.551) Software Testing: Theory and Practice
- CSI5118 (95.578) Design of Compilers and Translators
- CSI5518 (95.578) Conception des compilateurs et traducteurs
- CSI5584 (95.584) Programmation logique
- Theory of Computing*
- 70.482 Introduction to Mathematical Logic
- 70/95.483 Topics in Applied Logic
- 70/95.484 Design and Analysis of Algorithms
- 70/95.485 Theory of Automata
- 70.565 (MAT5165) Theory of Automata
- 70.585 (MAT5308) Topics in Algorithm Design
- 95.504 (CSI5305) Topics in Arithmetic Complexity
- 95.505 (CSI5390) Automata Models of Learning Systems
- 95.508 (CSI5164) Computational Geometry
- 95/70.587 (CSI5104) Formal Languages and Syntax Analysis
- CSI5101 (95.561) Formal Models of Computational Systems
- CSI5110 (95.577) Principles of Formal Software Development
- CSI5162 (95.572) Topics in the Theory of Computing
- CSI5163 (95.573) Algorithm Analysis and Design
- CSI5174T (95.564) Specification and Validation of Communication Software
- Computer Applications*
- 70/95.486 Numerical Linear Algebra
- 94.405 Discrete Simulation and Its Applications
- 95.402 Computer Graphics
- 95.403 Transaction Processing Systems
- 95.405 A First Course in Robotics and Computer Vision
- 95.407 Applied Artificial Intelligence
- 70.569 (MAT5301) Topics in Combinatorial Mathematics
- 70.581 (MAT5303/ADM6385) Linear Optimization
- 70.583 (MAT5304/ADM6386) Nonlinear Optimization
- 70.584 (MAT5307/ADM6387) Topics in Operations Research
- 70.586 (MAT5180) Numerical Analysis
- 70.588 (MAT5305) Combinatorial Optimization
- 70.589 (MAT5306) Combinatorial Optimization
- 94.501 (CSI5120) Simulation and Modelling
- 94.504 (ELG6104) Computer Methods in Industrial Engineering
- 94.505 (CSI5150) Optimization Theory and Methods
- 94.553 (ELG6153) Stochastic Processes
- 94.534 (ELG6134) Mini-Micro Applications
- 94.535 (ELG6135) Representations and Methods in Design Tools for Concurrent Systems
- 94.542 (ELG6142) Advanced Dynamics with Applications to Robots
- 95.506 (CSI5306) Natural Language Understanding
- 95/94.507 (CSI5307) Expert Systems
- 95.510 (CSI5180) Topics in Artificial Intelligence
- 95.513 (CSI5313) Cryptography
- CSI5161 (95.566) Topics in System Simulation and Optimization
- CSI5181 (95.575) Artificial Intelligence Applications in Software Development
- CSI5386 (95.555) Natural Language Processing
- CSI5387 (95.576) Machine Learning
- CSI5580 (95.510) Sujet en intelligence artificielle
- CSI5581 (95.575) Applications de l'intelligence artificielle dans le développement des systèmes
- CSI5887 (95.576) Apprentissage Symbolique Automatique
- ELG5119 (92.519) Stochastic Processes
- Computer Systems*
- 94.457 Introduction to the Architecture of Computer Systems
- 94.470 Introduction to Telecommunications
- 94.511 (ELG6111) Computer System Design for Performance
- 94.519 (ELG6119) Teletraffic Engineering
- 94.521 (ELG6121) Computer Communication
- 94.527 (ELG6127) Distributed Processing Systems
- 94.532 (ELG6132) System Engineering using VLSI Components
- 94.533 (ELG6133) Digital Systems Engineering
- 94.538 (ELG6138) Computer Architecture and Parallel Processing
- 94.539 (ELG6139) Advanced Topics in Digital Systems Design
- 94.558 (ELG6158) Digital Systems Architecture
- 94.576 (ELG6176) Analytical Performance Models of Computer Systems
- 94.577 (ELG6177) Teleprocessing Software Design
- 94.581 (ELG6181) Advanced Topics in Computer Communications
- 95.503 (CSI5308) Principles of Distributed Computing

- 95.509 (CSI5141) Associative Structures and Database Machines
- 95.511 (CSI5311) Distributed Databases and Transactions Processing Systems
- 95.512 (CSI5312) Distributed Operating Systems
- 95.515 (CSI5132) Parallel Processing Systems
- 95.574 (CSI5131) Parallel Algorithms and their VLSI Implementation
- 97.587 (ELG6387) Microprocessor Electronics
- CSI5114 (95.554) Automated Office Systems
- CSI5135 (95.565) High Level Language Machines
- CSI5170 (95.580) Distributed Data Processing
- CSI5171 (95.583) Software for Communication Networks
- CSI5514 (95.554) Bureautique
- CSI5535 (95.565) Les machines de haut niveau
- ELG5192 (92.577) Microprocessor-based Systems
- ELG5193 (92.578) Multi-microprocessor Systems
- ELG5374 (92.567) Computer Communication Networks
- ELG5378TH (92.559) Image Processing Techniques and Image Communications

Theses, Projects and Topics

- 70.591 Directed Studies
- 70.593 Project
- 94.596 Directed Studies
- 95.590 (CSI5140) Selected Topics in Computer Science
- 95.591 (CSI5900) Directed Studies
- 95.592 (CSI5900) Project
- 70/94/95.595 (CSI7999) M.C.S. Thesis



Departmental

Program

Descriptions

and

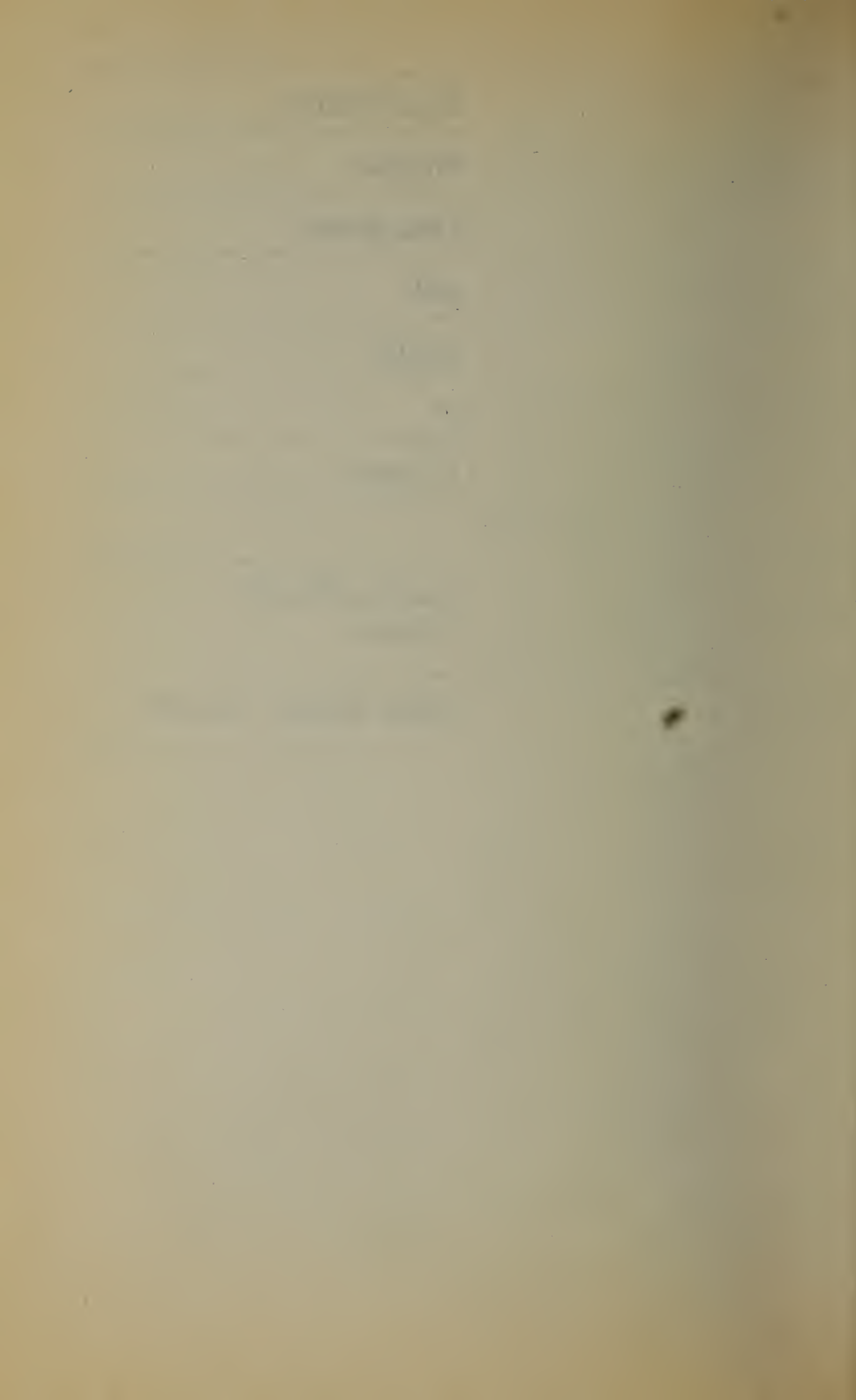
Details

of

Courses

Faculty of Social
Sciences

Dean: Marilyn Marshall



School of Business

Dunton Tower
788-2388

The Department

Director of the School: J.R. Callahan

Supervisor of Graduate Studies: G.H. Haines, Jr.

The School of Business offers a program of study and research leading to a Master of Management Studies degree.

The focus of the M.M.S. program is applied research directed toward the management of technology, productivity and innovation. The program of studies will develop in students the conceptual and methodological skills required to manage, plan, develop and implement technological capabilities for the purpose of attaining the strategic and operational goals of organizations.

The main areas of specialization within the program are:

- Business Information Systems
- Finance
- Management
- Marketing

Graduate students in the School of Business are governed by the section of this calendar entitled General Regulations, and by the regulations stated in that section.

Master of Management Studies

Admission Requirements

Admission into the program is judged primarily on the applicant's ability to undertake successfully advanced studies and research in business, his/her prospects for completion of the program, experience, and achievement.

Applicants are required to have the equivalent of an honours bachelor's degree, with a minimum of high honours standing. Applicants are expected to have had credits in mathematics and the following core courses in functional areas of business described below or their equivalents:

- Business 42.210*: Management and Organizational Behaviour
- Business 42.228*: Introduction to Marketing
- Business 42.230*: Introduction to Management Science
- Business 42.240*: Business Information Systems
- Business 42.250*: Introduction to Business Finance
- Economics 43.220: Statistical Methods in the Social Sciences

In addition, applicants are expected to have had an upper-level course sequence in their proposed area of business specialization, and to have an adequate

grounding in at least one supporting fundamental discipline such as economics, psychology, sociology, mathematics, anthropology or computer science.

The school requires that all applicants submit scores obtained in the Graduate Management Admission Test offered by the Educational Testing Services of Princeton, New Jersey. A superior GMAT score will be required for admission. All applicants whose native tongue is not English must take the TOEFL test and obtain a minimum score of 550.

The school's admission policy is governed by the availability of graduate student space. Possession of the minimum admission requirements does not, in itself, guarantee acceptance. Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the supervisor of graduate studies and must also be approved at the time of admission by the dean of the Faculty of Graduate Studies and Research. In general, a grade of B- or better is required in equivalent courses to obtain advanced standing.

Program Requirements

The requirement for the Master of Management Studies degree is the equivalent of five full courses of which at least four must be at the 500 level or above. Students must complete one and one-half full-course credits of required Business courses, one full-course credit from a selection of advanced seminars, one full-course credit of approved options and a thesis equivalent to one and one-half full-course credits as indicated below.

All master's students are required to complete:

Required Business Courses

- Business 42.592: Business Research Methods
- Business 42.595: Directed Research in Business Studies
- Business 42.597: M.M.S. Thesis Tutorial

Advanced Seminars

One full-course credit from the following list of half-courses:

- Business 42.510: Seminar in Management and Administration
- Business 42.520: Seminar in Marketing
- Business 42.540: Seminar in Information Systems Management
- Business 42.550: Seminar in Finance

Approved Options

The equivalent of one full-course credit of approved courses which may be selected from among those offered by the school and in related disciplines.

Thesis

• Business 42.599 M.M.S. Thesis

The M.M.S. thesis is equivalent to one and one-half full-course credits. The thesis would normally relate to issues that are relevant to producers and users of technology.

The thesis must represent the result of the candidate's independent research undertaken after being admitted to graduate studies at Carleton University's School of Business. Previous work of the candidate may be used only as introductory or background material for the thesis.

A candidate may carry on research work related to the thesis off campus provided that the work is approved in advance and arrangements have been made for regular supervision of thesis research activities with the school's supervisor of graduate studies.

All students require the school's approval for their proposed thesis topic. Each candidate submitting a thesis will be required to take an oral examination on the subject of the thesis.

Academic Standing

A grade of B- or better must normally be obtained in each course counted towards the degree. A candidate may, with the recommendation of the school and the approval of the dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half-courses.

Graduate Courses*

Enrolment in graduate courses requires the permission of the school through the supervisor of graduate studies.

• Business 42.510F1

Seminar in Management and Administration

A critical examination of research on decision-making and problem-solving behaviour in organizations. Particular attention will be given to the use of information and management techniques for decision-making in technology-driven organizations, and to management strategies of problem-solving in unpredictable circumstances.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Business 42.511W1

Seminar in Organizational Design

This course examines alternative concepts and forms of organizational design at both the administrative and operational levels. The emphasis will be on a critical analysis of design implications of high rates of environmental and technological change. Management structures, processes and technologies, which enhance productivity and innovation will be evaluated with special reference to comparisons between Canada and other industrialized countries.

• Business 42.520F1

Seminar in Marketing

This course examines issues in productivity and innovation as they relate to marketing. The course assumes the viewpoint of product portfolio management, and addresses problems such as market assessment, marketing audits and policy, new products, existing product management, and product line profitability. Particular emphasis is placed on marketing of technology-based products and the effect of technological developments on marketing practices.

• Business 42.521W1

Contemporary Marketing Thought

This course examines the state of the art in marketing thought, and prepares the student to cope with an ever changing environment. Topics include the development of paradigms in marketing, recent advances in consumer behaviour, the acquisition of data and information from the external environment, the influence of societal and environmental developments upon marketing, and new directions in marketing theory and practice.

• Business 42.530F1

Managing the Multinational Enterprise

This course examines issues in the management of multinational enterprises, e.g. optimizing productivity in multi-site environments, the dispersion of innovative products and ideas across national boundaries, and the management of cultural differences and their impact on the basic managerial functions of communication, planning, decision making and integration. The course will examine both Canadian-based multinational firms and externally-based firms with interests in Canada.

• Business 42.531W1

Seminar in International Business Management

This course examines specific topics in the area of international business management. Areas of interest include management in inter-cultural environment, issues in international financing, and business negotiations, international inter-firm alliances including joint ventures, etc. Students will be expected to make significant contribution to the discussion.

• Business 42.540F1

Seminar in Information Systems Management

This course is concerned with major issues in the

* At the undergraduate level, denotes a half-course credit.

managing of information technology. It covers the following major topics: organization of information services; planning, management and administration of information resources; assimilation and diffusion of information technology; integration of information services; and current opportunities and concerns in information services. The implications of these issues for managers are examined by the use of cases and projects.

- Business 42.541W1

Current Topics in Business Information Systems

This course examines trends and issues associated with business information systems within organizations. It covers topics such as analysis and design of information systems, end-user computing, data-bases, distributed systems, teleprocessing, office automation, data communications. Other topics may include modern technologies such as knowledge base systems and artificial intelligence.

- Business 42.550F1

Seminar in Finance

An analysis of contemporary theory of finance. This analysis includes: the examination of innovations in corporate financing; financial planning; financing strategies; valuation of contingent claims; implications of agency theory; etc. Particular emphasis is placed on financial decision of technology-based firms.

- Business 42.551W1

Seminar in Financial Research

This course examines research and empirical issues in investments, portfolio management, corporate finance, and capital markets. Particular emphasis will be placed on innovative research methods and financial innovations.

- Business 42.590T1 or T2

Tutorials/Directed Studies in Business

Tutorials or directed readings in selected areas of business, involving presentation of papers as the basis for discussion with the tutor. A requirement for the course may be participation in an advanced business course at the undergraduate level.

- Business 42.592F1

Business Research Methods

A consideration of the basic issues of scientific research as applied to business problems. The course includes a discussion of the logic of scientific research, proof and verification, hypothesis testing, the logic of statistical inference, and research design.

- Business 42.595F1

Directed Research in Business Studies

This course focuses on the integration of technology and strategy, the designing of a technological strategy, the development of new products and new businesses, and the design and management of innovative systems.

- Business 42.597W1, S1

M.M.S. Thesis Tutorial

A seminar designed to help the student formulate and evaluate specific research topics. The successful submission of a thesis proposal is necessary for the completion of the course.

- Business 42.599F2, W3, S3

M.M.S. Thesis Research

Prerequisite: Business 42.597.

Department of Economics

Loeb Bldg. C877
788-3743

The Department

Chair of the Department: E.U. Choudhri

Supervisor of M.A. Studies: T.K. Rymes

Supervisor of Ph.D. Studies: J.S. Ferris

Director of Joint Doctoral Program with the University of Ottawa: J.S. Ferris

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the department include the following:

- Industrial Organization
- Public Economics
- Monetary Economics
- International Trade
- Economic Theory
- Quantitative Methods

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program designed to raise their standing to honours status. If successful, they may be permitted to proceed to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an Ontario honours B.A. (or the equivalent) in Economics, with at least high honours standing.

Applicants are expected to have had adequate preparation in statistics and mathematics. Credit in the following two undergraduate courses (or their equivalent)

ents) will be accepted: Economics 43.220: Statistical Methods in the Social Sciences, or Mathematics 69.109: Calculus: with Applications to Business and Economics, and Mathematics 69.119: Algebra: with Applications to Business and Economics. Students who do not satisfy the statistics requirement will be asked to take Economics 43.592: Econometric Methods, prior to proceeding to Economics 43.505: Econometrics. Students with inadequate mathematical backgrounds will be required to enrol in Economics 43.593: Mathematical Methods for Economists.

The department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All master's students in economics are required to complete the following courses:

Economics

43.501 Microeconomic Theory I

43.502 Macroeconomic Theory I

43.503 Microeconomic Theory II

43.504 Macroeconomic Theory II

43.505 Econometrics

In addition, each candidate must select and complete one of the following:

- A thesis, equivalent to 1-1/2 credits and approved course(s) for one credit
- Approved courses for 2-1/2 credits, one of which may be selected from among those offered in a related discipline, with permission of the department, through the supervisor of M.A. studies.

Academic Standing

A grade of B- or better must normally be received in each course counted towards the master's degree. With respect to the required courses in the program there will be *no* exceptions. A candidate, with the recommendation of the Department and the approval of the Dean of the Faculty of Graduate Studies and Research, may be allowed a grade of C+ in one full or each of two half non-required courses.

Doctor of Philosophy

The doctoral program in Canadian economic policy and economic development, offered jointly by the Departments of Economics at Carleton University and the University of Ottawa, was launched in July, 1981.

The Ph.D. program stresses the application of economic theory to the analysis of Canadian economic

policy and economic development. Five areas of specialization are available for intensive study and thesis research: public economics, industrial organization, monetary economics, international economics, and economic development. The program of courses and thesis guidance, drawing upon the faculty of the two departments, will encompass course requirements, policy-oriented workshops, comprehensive examinations, and a thesis. Students who have achieved at least high honours standing at the M.A. level in economics, or who have equivalent training, may be required to take one half-course at the graduate level in Canadian or North American economic history (or the equivalent) if they have not already taken such a course at the graduate level. Students are also expected to have, or to acquire proficiency in mathematics and statistics before proceeding with the program.

While satisfying the course requirements, a student must be enrolled on a full time basis for three consecutive terms.

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree (or the equivalent) from a recognized university, with high honours standing. The department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance, and who demonstrates high promise for advanced research during the master's program may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without completing the M.A. program.

- The student will have completed Economics 43.501, 43.502, 43.505, plus an additional four half-courses at the graduate level
- The student must make formal application to the Graduate Studies Committee at least one month before the beginning of the term in which he/she wishes to begin the Ph.D. program
- Students permitted to transfer into the Ph.D. program will be required to complete the equivalent of 11-1/2 courses.

Program Requirements

Students admitted to the Joint Ph.D. program are required to complete three compulsory half-courses: microeconomic theory, macroeconomic theory, and one of:

- advanced econometrics
- mathematical economics
- economic models and policy applications
- research methods in economics
- theory of choice.

Students are required to take three half-courses in each of two fields of specialization. Credit may be

given for previous graduate courses in either of the chosen fields. Courses in the fields of specialization will be:

Public Economics

- Public Economics: Expenditure
- Public Economics: Taxation
- Public Choice
- Fiscal Federalism

Industrial Organization

- Firms and Markets
- Competition Policy
- Regulation and Public Enterprise
- Economics of Natural Resources

Monetary Economics

- Microeconomic Aspects of Monetary Theory
- Macroeconomic Aspects of Monetary Theory
- Aspects of Financial Intermediation
- Explorations in Monetary Economics

International Economics

- International Trade: Theory and Policy
- International Monetary Theory and Policy
- Topics in International Economics
- Economic Development: International Aspects

Economic Development

- Theory of Economic Development
- Economic Development: Internal Aspects
- Economic Development: International Aspects
- Planning for Economic Development

Comprehensive Examinations

Oral examinations are not compulsory but a candidate may be required by the examining committee to sit an oral examination.

- Theory

Each student will attend the Ph.D. Tutorial course, 43.690 (ECO7990), in preparation for the theory comprehensive examinations. There are two theory examinations to be written, in micro- and macro-economics.

- Fields

Students will be required to write comprehensive examinations in two fields.

Thesis and Workshop Requirements

Doctoral students will write and defend a Ph.D. dissertation. In preparing the dissertation, the student is required to give two seminars in departmental workshops. In the first, a research proposal for the dissertation will be presented and evaluated by three faculty members of the relevant workshop. In the second, a substantial portion of the research for the dissertation will have been completed and will be presented and evaluated as above. These workshops are requirements for graduation, and students will receive two half-credits for them.

Workshops

Students are encouraged to attend and participate in the regular departmental workshops relevant to their

fields of interest and research. Such workshops are conducted in three areas:

- Government and the Market Place (Industrial Organization)
- Evaluation of the Public Economy (Public Finance)
- Canada and the World Economy (International Trade & Finance and Development)

Further details about this Joint Ph.D. program may be obtained by writing to the Director of Doctoral Studies, Joint Doctoral Program in Economics, either at the Department of Economics, Carleton University, or at the Department of Economics/Département de Science Économique, University of Ottawa.

Academic Standing

Doctoral students must normally obtain a grade of B- or better in each course counted towards the degree.

Qualifying-Year Courses*

- Economics 43.590F1

Microeconomic Theory

This course is required for qualifying-year students whose preparation in microeconomic theory is judged to be inadequate.

- Economics 43.591W1

Macroeconomic Theory

This course is required for qualifying-year students whose preparation in macroeconomic theory is judged to be inadequate.

- Economics 43.592F1

Econometric Methods

Principles of statistical theory, probability, testing, and introduction to regression analysis.

Designed for those judged deficient in undergraduate statistical training.

- Economics 43.593F1

Mathematical Methods for Economists

This course provides an introduction to the use of mathematical techniques in economics. Topics in optimization, such as Lagrangean multipliers and second order conditions, will be emphasized. Applications of these tools to various parts of economic theory will be presented.

- Economics 43.594F1, W1, S1

Qualifying-Year Tutorial

A tutorial for qualifying-year students whose program includes the full slate of qualifying-year core courses (microeconomic theory, macroeconomic theory, empirical methods, and applied economics).

- Economics 43.595F1, W1, S1

Qualifying-Year Directed Studies

- Economics 43.597F1, W1, S1

Qualifying-Year Directed Readings

Graduate Courses*

Enrolment in graduate courses requires the permission of the department, through the supervisor of graduate studies.

- Economics 43.501F1

Microeconomic Theory I

An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price determination.

- Economics 43.502F1

Macroeconomic Theory I

Macroeconomic theory and its implications for economic policy are surveyed in this course, comparing alternative approaches for a variety of topics.

- Economics 43.503W1, S1

Microeconomic Theory II

A continuation of Microeconomic Theory I.

- Economics 43.504W1, S1

Macroeconomic Theory II

A continuation of Macroeconomic Theory I.

- Economics 43.505F1

Econometrics

Estimation and testing of the general linear model, with emphasis on problems such as autocorrelation, heteroscedasticity, multicollinearity, and problems due to distributed lags and errors in variables. Introduction to simultaneous equations systems, identification, and estimation.

- Economics 43.507F1, W1, S1

Directed Readings

Prerequisite: Permission of the department.

- Economics 43.508F1, W1, S1

Special Topics

Prerequisite: Permission of the department.

- Economics 43.509F1, W1, S1

Directed Research

At least one paper will be required from a student enrolled in any one of these courses.

Prerequisite: Permission of the department.

- Economics 43.511F1

Canadian Economy I

A detailed examination of aspects and problems of the Canadian economy. A variety of topics may be discussed, including the economic development of Can-

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

ada, the structure of the current national and regional economies, industrial organization, factor market operation, income distribution, the role of international trade and capital flows, and the stability of the economy.

- Economics 43.512W1

Canadian Economy II

Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution, and aggregate economy. Participants are expected to prepare and present papers for discussion.

- Economics 43.521F1

History of Economic Thought I

The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the interrelationship between the social environment and economic thought — especially to the role of economics in the development of the national state and international institutions.

- Economics 43.522W1

History of Economic Thought II

A continuation of 43.521.

Prerequisite: Economics 43.521 or permission of the department.

- Economics 43.525F1 (ECO7125;7525)

Mathematical Economics

General equilibrium; dynamic optimization; game-theory.

- Economics 43.531F1 (ECO6140; 6540)

Firms and Markets

An examination of theories pertaining to industrial organization, and their application to particular industries in Canada and elsewhere by way of empirical studies.

- Economics 43.532W1 (ECO6141; 6541)

Competition Policy

An examination of the rationale and application of competition policy with particular attention to the Canadian economy.

- Economics 43.533S1 (ECO6142; 6542)

Regulation and Public Enterprise

An examination of regulation and public enterprise as alternative approaches for influencing industry conduct and performance.

- Economics 43.535F1 (ECO6143;6543)

Economics of Natural Resources

Elements of dynamic optimization. Microeconomic theory of exhaustible natural resources, both renewable and non-renewable: exploration, development and production. Uncertainty: sources, types, the value of information, informational externalities, search. Optimal jurisdiction over regulation and taxation of

natural resources. Canadian case studies. Macroeconomic theory: intergenerational equity, technological substitution and impact upon growth.

- Economics 43.538W1

Law and Economics

This is a course in the interrelationship of law and economics, emphasizing the concepts of transaction costs and property rights. Economic theory will be used to analyze a variety of topics, ranging from the allocative effects of alternative property rights structures to contract, tort, and nuisance law. Special attention will be given to applied problems, such as the economics of crime, pollution, pay television, and eminent domain.

- Economics 43.539W1

Applied Industrial Economics

This course examines the application of industrial economics, with special emphasis to the Canadian and North American economies. Topics include the structure of consumer demand, firm production and investment, industrial structure and international trade. The structure of production and investment of particular industries will be analyzed and the effect of government policies (such as tax and tariff) on industrial development will be examined.

- Economics 43.541F1 (ECO6130; 6530)

Public Economics: Expenditure

A discussion of the role of government expenditure, both in theory and with reference to the Canadian economy.

- Economics 43.542W1 (ECO6131; 6531)

Public Economics: Taxation

An analysis of the effects of various forms of taxation on economic performance.

- Economics 43.543W1 (ECO6133; 6533)

Public Choice

Democracy, bureaucracy, and economic policy. The public choice of fiscal constitutions, tax shares, and equity rules; voting coalitions and income distribution; the public provision of private goods; public sector size, fiscal illusion, and taxpayer revolts.

- Economics 43.544W1 (ECO6132; 6532)

Fiscal Federalism

This course examines the economic aspects of federalism, including efficiency, redistribution, consideration of a federal system of government, intergovernmental grants, and problems of stabilization policy in a federal context.

- Economics 43.545W1

Theoretical Welfare Economics

A rigorous treatment of the theoretical foundations of welfare economics.

- Economics 43.547W1

Project Evaluation

An analytical treatment of the principles of project evaluation and their applications.

Prerequisite: Economics 43.501 or permission of the department.

- Economics 43.550F1 (ECO6170; 6570)

Theory of Economic Development

This course will deal with theoretical approaches in the economic development literature in relation to the historical, economic, social and political dimensions of the development process.

- Economics 43.551F1

Economic Dynamics: Cycles

An analysis of the nature and causes of fluctuations in income, prices, and employment. Shortrun dynamic models arising from multiplier-accelerator and other economic processes will be examined. Cycle simulation, forecasting, stability conditions, anti-cyclical policy, and the problems of maximizing growth without cycles will be discussed.

- Economics 43.552W1

Economic Dynamics: Growth

An examination of modern theories of economic growth.

- Economics 43.553W1

Stabilization Policy

An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.

Prerequisite: Economics 43.502.

- Economics 43.554W1 (ECO6171; 6571)

Economic Development: Internal Aspects

An analysis of some major domestic problems of economic development. Topics may include employment, income distribution, choice of technology, sectoral allocation of resources and human resource development.

- Economics 43.555F1 (ECO6172; 6572)

Economic Development: International Aspects

An analysis of some key problems of international economic development such as trade in primary commodities and manufactures, foreign assistance, the role of multinational corporations and the transfer of technology.

- Economics 43.556W1 (ECO6309; 6709)

Planning for Economic Development

An analytical treatment of the principles of economic development planning and project evaluation and their applications.

- Economics 43.561F1 (ECO6160; 6560)

International Trade: Theory and Policy

International trade theory and its implications for economic policy are examined, with emphasis on topics such as determinants of trade and specialization, gains from trade and commercial policy, international factor mobility, growth, and development.

- Economics 43.562W1 (ECO6161; 6561)

International Monetary Theory and Policy

International monetary theory and its implications for economic policy are examined, with emphasis on topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed versus flexible exchange rates, international capital movements, and recent issues in the international monetary system.

- Economics 43.563W1 (ECO6162; 6562)

Topics in International Economics

An examination of key topics in international economics, including theoretical analysis, quantitative methods and policy formulation, implementation, and evaluation.

Prerequisite: Economics 43.561 or 43.562.

- Economics 43.566F1 (ECO6180; 6580)

Microeconomic Aspects of Monetary Theory

A course on the microeconomic foundations of monetary theory concerned with alternative theories for the existence of money and ranging in coverage from commodity monies to private monies with banking systems to costless fiat money systems. The focus of the course will be on how money integrates with the theory of value and the different theoretical ways in which this integration has been modelled.

- Economics 43.567W1 (ECO6181; 6581)

Macroeconomic Aspects of Monetary Theory

A course in monetary theory that deals with the macroeconomic interactions of money. Issues will include such topics as: inflation, money and wealth; the optimum quantity of money; the welfare aspects of monetary economies; the supply of money and its composition; stabilization policy; money, capital and growth.

- Economics 43.568F1 (ECO6182; 6582)

Aspects of Financial Intermediation

The evolution of the financial system with special emphasis on the theory of financial institutions and its inter-relationship with the money supply process and the central bank. The course is designed to use contemporary monetary and finance theory to analyze institutional problems in both their historical and contemporary settings.

- Economics 43.569W1 (ECO6183; 6583)

Explorations in Monetary Economics

A course in which explorations in theory, policy recommendations and empirical study are undertaken. The material challenges traditional approaches by examining such topics as the endogeneity of money, the role of credit, the finance motive, the circuit approach, flow of funds analysis and austerity policies.

- Economics 43.571W1 (ECO7126; 7526)

Advanced Econometrics

Selected topics from estimating and testing the regression and simultaneous equation models are analyzed. The main topics include maximum likelihood estimation, statistical analysis of residuals, autoregressive and

other time-series models, multivariate regression model, and elements of asymptotic statistical theory within the context of the simultaneous equation model.

Prerequisite: Economics 43.505 or equivalent.

• Economics 43.572W1

Applied Econometrics

A discussion of the major problems encountered in applying the tools and techniques of econometric methods to statistical data for economic analysis and forecasting. Some selected topics and papers from the applied econometric literature are critically analyzed and appraised.

Prerequisite: Economics 43.505 or equivalent.

• Economics 43.573W1

Applied Time Series Analysis

Introduces the basic concepts of time series analysis with emphasis on models used in economics. Topics include stationary and nonstationary time series, model identification and estimation, transfer functions, and forecast computation.

• Economics 43.581F1

Regional Economics

Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure and to growth determinants.

• Economics 43.582W1

Urban Economics

An examination of the economic properties of urban areas. Attention will be focused on the macro-dynamics of urban development, together with the micro-statics of the equilibrium properties of the urban land market.

• Economics 43.586F1

Comparative Economic Systems I

This course builds a framework for the study and comparison of economic systems. Using basic economic tools, it discusses the properties and comparative advantages of different contemporary economies, as well as the forces that cause or prevent change. Some Marxian theory will be included, along with analyses of the role of property rights, of incentives and motivation, and of the interaction between economic and political systems.

• Economics 43.587W1

Comparative Economic Systems II

A comparison of contemporary economic systems. Such diverse economies as Japan, West Germany, Sweden, the USSR, China, Cuba, Yugoslavia, and Hungary may be explored.

Prerequisite: Economics 43.586 or permission of the department.

• Economics 43.599F3, W3, S3

M.A. Thesis

• Economics 43.600F1 (ECO7922)

Economic Theory: Microeconomics

An examination of critical aspects of microeconomic theory drawn from recent analysis of consumer behaviour, costs and production, transaction costs, uncertainty, and the organization of economic activity.

Prerequisite: Economics 43.501 or equivalent.

• Economics 43.601W1 (ECO7923)

Economic Theory: Macroeconomics

An examination of critical aspects of macroeconomic theory drawn from recent analysis of the microeconomic foundations of macroeconomics, concepts of macroeconomic equilibrium and the impact of monetary and fiscal disturbances. Attention is also directed to a variety of topics related to the conduct of macroeconomic policy.

Prerequisite: Economics 43.502 or equivalent.

• Economics 43.604W1 (ECO7127;7527)

Theory of Choice

The concept of choice in economics. Opportunity for choice. Criteria of choice. Individual choice. Collective and social choice. Methods of choice. Applications.

• Economics 43.606F1 (ECO7930)

Economic Models and Policy Applications

Selected topics in the literature of econometric model building and consideration of their relevance to the design of economic policy. Included is a survey and comparative analysis of existing Canadian and American macroeconometric models. A detailed examination of one Canadian model will be made, and students will have the opportunity to conduct policy simulations with it or another econometric model.

Prerequisite: Economics 43.505 or equivalent.

• Economics 43.607W1 (ECO7900)

Research Methods in Economics

Philosophy of science and scientific methods. A critique and an appraisal of the basic postulates of the classical, neo-classical, Marxian, Keynesian and post-Keynesian modes of theorizing in relation to the following three principles of scientific inquiry: rigor, realism and relevance. The concepts of structure, function, structural change and evolution. Structural stability and the theory of catastrophes in economics.

Prerequisite: Economics 43.505 or equivalent.

• Economics 43.611F1, W1, S1 (ECO7010; 7011; 7012)

Workshop in Economic Policy

See requirements on page 000.

• Economics 43.670F1, W1, S1 (ECO7980)

Reading Course in Canadian Economic Policy and Economic Development

• Economics 43.690W1, S1 (ECO7990)

Ph.D. Tutorial

Students must register in the microeconomics and macroeconomics tutorials in either the winter or spring term.

• Economics 43.699F10, W10, S10 (ECO9999)

Ph.D. Thesis

Department of Geography

Loeb Bldg. B349
788-2561

The Department

Chair of the Department: David Bennett
Departmental Supervisor of Graduate Studies:
Iain Wallace

The Department of Geography offers programs of study and research in human and physical geography leading to the degree of Master of Arts. Master of Science and Doctoral studies in physical geography can be undertaken in co-operation with the Ottawa-Carleton Centre for Geoscience Studies. Doctoral studies in other fields of geography may, in special cases, be undertaken in co-operation with other departments.

Students are accepted into the graduate program based on the standard of previous academic work, research interests, letters of reference, and the availability of faculty to act as supervisors. Each student's program of study, as far as possible, is based on the interests of the individual, although certain courses may be required. An advisory committee, consisting of the student's research supervisor and at least one other member of the faculty, is established to monitor progress and provide thesis research guidance.

Excellent research laboratory facilities exist for the geotechnical study of near surface processes, and the physics, chemistry and thermodynamics of earth materials, as well as for computer cartography and for remote sensing. These facilities are supported by a highly qualified full-time staff in laboratory instrumentation, cartography, and computing. There is a specialized Map Library in the geography building. The University's location in Canada's capital city offers students access to important federal resources, such as the National Library, the Public Archives of Canada, the Canada Centre for Remote Sensing, Statistics Canada, and the specialist libraries of many government departments.

Specialist interests of departmental members are applied to a variety of world regions, although stress is given to Canada (including northern studies) and the Third World (especially Africa). The main clusters of specialization within the department are the following:

Physical Geography and Geotechnical Science

Studies of natural processes close to the earth's surface and their geotechnical significance; climate-ground interaction; geocryology; chemical, physical and thermodynamic characteristics of soils and sediments; hydrology.

(Peter Johnson, Alan Judge, Roy Koerner, Michael Smith, Ken Torrance, Tom Wilkinson, Peter Williams)

Resource Development

Identification and analysis of development processes; the interplay of environmental, demographic, social, gender, political, and economic variables in the spatial development of land resources, settlement systems, outdoor recreation, tourism, and natural resource-based industries; environmental impact assessment and environmental management; Canadian and Third World development are stressed.

(Duncan Anderson, John Clarke, Michael Fox, Peter Johnson, David Knight, Fiona Mackenzie, Gennady Ozornoy, Michael Smith, William Smith, Gordon Taylor, Fraser Taylor, Kenneth Torrance, Iain Wallace, Tom Wilkinson)

Cultural, Historical, and Political Geography

Rural and urban settlement history; ethnicity; territorial organization and the concepts of state, group politico-territorial identities, territoriality, and self-determination; role of territory in conflict situations; perceptions of environment and geographies of the mind; gender as a cultural variable; urban heritage conservation.

(John Clarke, David Knight, Suzanne Mackenzie, John Tunbridge)

Social and Economic Geography

Geographical analyses of the social and economic organization of societies; areal variations in social well-being; medical geography; provision of public and informal services in changing local and regional environments; implications of gender roles for environmental restructuring; industrial systems; philosophy of science and of geography.

(David Bennett, Fran Klodawsky, Fiona Mackenzie, Suzanne Mackenzie, Gennady Ozornoy, Iain Wallace)

Computer Cartography and Remote Sensing

Development of applications in computer cartography and the use of remote sensing in geographical research. (Michael Fox, Peter Johnson, Andrew Rencz, Fraser Taylor, Tom Wilkinson).

The opportunity for wider experience in cartography may be obtained through arrangements by which a student may take for credit at Carleton University one or more courses in cartography offered by the Department of Geography, Queen's University. The principal areas of focus are map design and history of cartography at Queen's, and applied aspects of computer-assisted cartography at Carleton. Students following the co-operative cartography program may register in either department, and will follow the normal regulations and requirements of their university of registration. When appropriate for students in the co-operative program, representatives from both universi-

ties may be members of a student's thesis examining board. Financial aid for transport between cities will be provided by the home department.

Qualifying-Year Program

Applicants with exceptional promise who have a general (pass) bachelor's degree, or who have substantially less than the honours B.A. in Geography may be admitted to a qualifying-year program. To be considered for admission into the master's program, qualifying-year students must attain at least an overall high honours standing in their qualifying-year geography courses. The general section of this calendar provides details about the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an honours B.A. or B.Sc. in Geography with at least high honours standing. In exceptional cases, pertinent work experience may be considered in support of an application to the department. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering, as well as in physical geography, will be considered if their research interest coincides with those of the department. Applicants in human geography may be accepted from related fields if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

Program Requirements

The M.A. in Geography normally takes from 12 to 18 months, but field work may necessitate some extension. All master's students in geography are required to complete a minimum of five full courses or the equivalent, including an M.A. thesis (equivalent to two full courses) which must be successfully defended at an oral examination. All students are required to have a reading knowledge of the language considered essential to their research.

In addition to the formal requirements it is required that M.A. students will normally attend a Graduate Field Camp and the Departmental Seminar series.

Graduate Courses*

In addition to the selection of courses offered by the department, graduate students in geography are encouraged to consider, in partial fulfilment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science, and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program; permission of departments in both universities is required.

The following courses, normally offered annually, are tentatively scheduled for 1989-90:

- Geography 45.500F1

Graduate Research Seminar

A review of competing philosophies in geography, and an analysis of the research implications of particular theories of knowledge including the application of scientific principles of investigation to contemporary research in geography.

David Bennett.

- Geography 45.505W1

Global Environmental Change: Human Implications
The nature of contemporary changes in global environmental systems and their significance for society, the economy and international relations. Phenomena such as climatic warming, deforestation, and the environmental pressures of urbanisation and intensive agriculture are analysed in terms of their regionally differentiated impacts and challenges for societal adaptation. (Also offered as International Affairs 46.571)

M.W. Smith and I. Wallace.

- Geography 45.517F1, W1, S1

Field Study and Methodological Research

Field acquisition and analysis of geographic material; supervised field observations and methodology. (Individual or group basis, by special arrangement.)

Co-ordinator: Supervisor of Graduate Studies.

- Geography 45.520W1

Issues in Development in Africa

Analysis of structures and processes of political, social and economic change in intertropical Africa at scales ranging from that of the local community to those of the nation state and international system. Alternative development policies and practices in rural and urban

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

areas (including regional planning strategies) will be examined.

(Also offered as International Affairs 46.563)

Fiona Mackenzie.

• Geography 45.530W1

Soil Thermal and Hydrologic Regimes

Characteristics of soil regimes, particularly in freezing soils; role of soil properties; analytical and numerical methods, including computer simulation.

(Alternates with Geography 45.532)

M.W. Smith.

• Geography 45.534W1

Aspects of Clay Mineralogy and Soil Chemistry

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

J.K. Torrance.

• Geography 45.537W1

Soil Resources

The properties of soils; development, classification, productive potential, and management problems of the world's soils. Primary emphasis will be agricultural, but environmental and geotechnical aspects will be considered.

J.K. Torrance.

• Geography 45.540F

Territory and Territoriality

Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self-determination, conflict, and processes of development.

(Also offered as International Affairs 46.542)

D.B. Knight.

• Geography 45.541F1

Society and Space

Analysis of geographers' contributions to contemporary social theory and of the geographical significance of theoretical debates in related fields.

Members of the Faculty.

• Geography 45.542F1, W1

Selected Concepts in Social Geography

Theme to be announced.

• Geography 45.543F1

Selected Concepts in Cultural Geography

Investigation of a substantive theme in cultural geography.

Theme to be announced.

Suzanne Mackenzie.

• Geography 45.544F1

Gender and Environments

This course examines the relation between gender role change and the creation and use of environments. Changes in people's activities, in the first and third worlds, are assessed in the context of feminist analyses.

Conceptual and methodological skills for gender-sensitive research are developed. Subsequent directed field experience may be achieved by taking 45.517.

• Geography 45.545F1

Problems in Historical Geography

Philosophical and methodological approaches in geography, history, and historical geography, emphasizing the use of primary documents, model building and statistical methods as they relate to the historical geography of Canada.

John Clarke.

• Geography 45.550F1

Spatial Dynamics of Urban and Regional Change

A review of recent theoretical and methodological debate in this field and analysis of the changing geography of production, employment and social consumption in advanced economies. Policy issues will be considered.

Members of the Faculty.

• Geography 45.555W1

Tourism and International Development

The nature and effect of tourist development in various parts of the world, and the role of tourism in developed and developing countries.

G.D. Taylor.

• Geography 45.558W1

Agribusiness North and South

Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in advanced industrial societies and of their penetration into, and impact upon, Third World economies.

(Also offered as International Affairs 46.534)

• Geography 45.570W1

Problems of Development in Arctic and Subarctic Environments

Research seminar on specific problems in Canada's northland. Experience from other parts of the world will be incorporated when appropriate.

• Geography 45.572W1

Issues in Canadian Resource Development

An overview of Canadian natural resource problems and prospects, concentrating on agriculture, forestry, energy, minerals, and offshore resources.

• Geography 45.579F1

Research and Development in Outdoor Recreational Geography

Developments and research in Canadian recreational land use; leisure time trends and recreational land use patterns, supply and user preferences, impacts and conflicts, wilderness recreation, landscape classification, and park system planning and management.

D.M. Anderson.

- Geography 45.580W1

Spatial Information Systems and Computer

Cartography

The concepts and problems involved with spatial information systems, especially those with a mapping component.

Gordon Deecker.

- Geography 45.581F1 or W1

Seminar in Map Design

A seminar on selected problems in the design, construction, and appreciation of maps.

(Offered at Queen's University as 38.850)

- Geography 45.582F1 or W1

Seminar in Historical Cartography

A seminar on selected problems in historical cartography.

(Offered at Queen's University as 38.877)

- Geography 45.590F1, W1, S1

Graduate Tutorial

Tutorial, directed reading or research, offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the department.

Co-ordinator: Supervisor of Graduate Studies.

- Geography 45.599F4, W4, S4

M.A. Thesis

Thesis supervision will be given in all areas of specialization of the department, as listed in the calendar section identifying departmental specializations.

Co-ordinator: Supervisor of Graduate Studies.

Courses Not Offered in 1989-90

45.532 Soil Thermal and Hydrological Properties

45.533 Periglacial Geomorphology

45.536 Floating Ice Studies

The Norman Paterson School of International Affairs

Paterson Hall, level 2A
788-6655

The School

Director of the School: C.J. Maule

Associate Director: M. Rudner

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the late Senator Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on three themes:

- Conflict Analysis
- Development Studies
- International Political Economy

The program affords students the opportunity to focus on Canada in international affairs through specialized courses related to each of these themes. The program also allows students to focus on international management issues relevant to governmental and non-governmental organizations and international enterprise. Attention is also paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The school maintains close co-operation with the Institute of Soviet and East European Studies, and with committees designed to encourage and co-ordinate faculty and student interests in Africa, Asia, and Latin America.

A specialized resource centre is located in the school and is staffed by a full-time information specialist. Students and faculty have access to a broad range of current bibliographic materials, using the resources of the national capital area as well as on-line computerized bibliographic services in foreign policy and international affairs. The school also participates in the Social Science Data Archives at Carleton, and students have access to a full range of data sets available from the Inter-University Consortium for Political Research, as well as the Canadian Institute of Public Opinion poll data and the Human Relations Area Files.

Qualifying-Year Program

Admission Requirements

The qualifying-year program is designed to enable students with at least high honours standing, but with an inadequate background in the disciplines relevant to the M.A. program, to make up deficiencies. Candidates with a general (pass) bachelor's degree, in a discipline closely related to international affairs, will be required to take five qualifying-year courses before being eligible to enter the master's program. Those

with an honours bachelor's degree in an unrelated discipline may be required to take at least three qualifying-year courses before being eligible to enter the master's program.

Students in the qualifying year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfil the language requirements of the M.A. program.

Admission to the qualifying year does not guarantee admission to the M.A. program. To be considered for admission to the M.A. program, students in the qualifying year are expected to achieve the equivalent of high honours standing. Students in the qualifying year are considered for admission to the M.A. program at the same time as other applicants; if qualifying year students are not admitted to the M.A. program in the first round of admissions, subsequent decisions on their admission will depend on performance and the availability of space in the M.A. program.

Program Requirements

Conflict Analysis

Students will normally enroll in Political Science 47.361 and 47.365, or 47.460. Students who have not already taken an introductory course in international politics should enroll in Political Science 47.260. Courses in anthropology, economics, geography, history, law and sociology, among other disciplines are recommended as well as courses concerned with alternative approaches to conflict and conflict resolution, and area studies.

Development Studies

Students will normally enroll in Economics 43.363. Students who have not already taken an introductory economics course should enroll in Economics 43.100. Courses related to development studies in anthropology, geography, history, law, political science, and sociology, among other disciplines are recommended as well as courses concerned with international economics and politics, and comparative and area studies.

International Political Economy

Students will normally enroll in Political Science 47.361 and 47.365, or 47.460, and Economics 43.360, or 43.361 and 43.362. Students who have not already taken an introductory economics course should enroll in Economics 43.100. Courses in anthropology, geo-

graphy, history, law, and sociology, among other disciplines, are recommended as well as courses concerned with political economy, the state, economic history, and comparative and area studies.

Master of Arts

Admission Requirements

The minimum requirement for admission into the master's program is an honours bachelor's degree in a discipline related to international affairs. Under current practice, at least a high honours standing is normally required for consideration for admission to the program.

Students may wish to provide scores on the Graduate Record Examination aptitude test in order to assist the admissions committee.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in the application for admission section, page 12 of the general regulations in this calendar.

Candidates who lack the required background in international affairs will be expected to complete a maximum of two additional courses. Core seminar requirements are listed under program requirements for qualifying year.

Students admitted to the *Conflict Analysis* core are strongly encouraged to complete a senior undergraduate course in conflict theory as well as courses in the social sciences, history, and law before beginning their programs. Students who have not completed a senior undergraduate half-course in conflict theory will be required to take such a course as part of their program requirements.

Students admitted to the *Development Studies* core are strongly encouraged to complete an undergraduate half-course in development economics before beginning the M.A. program. Otherwise, this requirement (additional to the M.A.) will have to be taken simultaneously with the M.A. program, and may result in some delay in its completion.

Students admitted to the *International Political Economy* core must complete an introductory economics course prior to entry in the M.A. program. Students are also strongly encouraged to complete undergraduate courses in political economy, international economics, and international politics, as well as courses in geography, history, law and sociology before beginning their programs. Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

Program Requirements

The normal program requirements for M.A. students in international affairs are:

- One interdisciplinary core seminar or equivalent selected from the following:

International Affairs

46.500 Theories and Approaches to International Political Economy

46.505 and 46.507 Development Studies

46.515E Conflict Analysis

- Two other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a thesis
- Three other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a research essay
- A thesis (valued at two credits) or a research essay (valued at one credit) involving original research on an approved subject in the field of international affairs
- Full time students are expected to submit a thesis/research essay proposal by the end of January following their first term of study in the program; part-time students are expected to submit a thesis/research proposal after completion of half of their course requirements.
- An ability to read a second major international language, or a language appropriate to a student's major research interest
- An oral comprehensive examination, primarily on the thesis or research essay and core seminar, to determine the candidate's ability to relate various disciplines to the study of international affairs.
- English-speaking Canadian students are expected to develop proficiency in French.

Canadian Concentration

Students may elect to include a Canadian concentration as part of their program. This concentration shall include:

- one of the three interdisciplinary core seminars or equivalent
- one of International Affairs 46.511, 46.512, 46.513
- A thesis or a research essay on a Canadian theme.

International Management Concentration

Students may elect to include international management as part of their program in the school. This concentration will emphasize aspects of the international environment in which managers in the public and private sectors make decisions. It will be of particular interest to students who wish to pursue careers in international governmental and non-governmental organizations, international banking and multinational enterprises. The concentration will be designed in consultation with a faculty co-ordinator and will include:

- one of the three interdisciplinary core seminars
- International Affairs 46.544

- courses from among those offered by the School of International Affairs and by the Schools of Business and Public Administration
- a thesis or a research essay on an international management topic.

Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

Academic Standing

A grade of B- or better must be obtained in each course credited towards the master's degree. The school does not permit exceptions to this rule.

Career Planning

Students interested in continuing to doctoral programs should plan their programs to include courses in their discipline, if other than international affairs, which may be deemed necessary for their admission to doctoral programs. Interdisciplinary doctoral programs in international affairs are given in a number of institutions and the faculty can provide guidance in planning for these programs.

Recent experiences of students show that a strong background in research methods and economics enhances job placement, and students may wish to take this into account in planning their course program.

School faculty can provide advice on careers in government, international governmental and non-governmental organizations, and in the private sector.

Graduate Courses*

Part-time students are permitted to enrol in a maximum of two half-courses per term.

Core Seminars

- International Affairs 46.500T2

Theories and Approaches to International Political Economy

A study of global political economy, with emphasis on historical development, regional integration, and contemporary institutional structures.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

- International Affairs 46.505F1 or W1
- International Dimensions in Development Studies

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Issues in development financing, international trade, industrialization and technology transfer, food and natural resources, and the role of international organizations.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

- International Affairs 46.507F1 or W1
- Theories of Development and Underdevelopment
A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

Students electing development studies as their core seminar will be required to complete both 46.505 and 46.507.

- International Affairs 46.515T2

Conflict Analysis

A seminar comparing conflict theory drawn from strategic studies, peace research, and the social sciences, with applications to East-West conflict, regional conflicts, arms races and arms control, crisis management, and terrorism.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

Canadian Concentration

- International Affairs 46.511W1

Canada in the International Political Economy

Analysis and evaluation of Canada's relationships and policies within the context of the international political economy.

Prerequisite: Enrolment in International Affairs 46.500 or permission of the school.

- International Affairs 46.512W1

Canada and International Development

Analysis and evaluation of Canada's policies and programs with respect to international development.

Prerequisite: Enrolment in International Affairs 46.505 and 46.507, or permission of the school.

- International Affairs 46.513W1

Canada and International Conflict

Analysis and evaluation of Canada with respect to international conflict and conflict resolution.

Prerequisite: Enrolment in International Affairs 46.515 or permission of the school.

Other Courses

- International Affairs 46.506F1 or W1

Agriculture and Rural Development

A study of the agricultural sector, rural areas, and rural welfare in developing countries, including consideration of structural change in agriculture, agrarian

reform, rural development strategies in various countries, and public policies affecting agriculture, activities ancillary to agriculture, rural industry, and public service.

- International Affairs 46.508F1 or W1

Development Planning: Theory and Practice

Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

- International Affairs 46.520F1

Strategy in the Nuclear Age

This course examines the relationships among nuclear weapons, national security policy and international affairs. Topics include the nature and effect of nuclear weapons, strategies for their use and non-use, the history of nuclear forces and doctrine since World War II, and a number of contemporary issues.

- International Affairs 46.521W1

Theory and Practice of Arms Control

This course explores the theoretical and analytical underpinnings of modern arms control with special emphasis on the impact of political, economic, technical and diplomatic factors. Topics include superpower negotiating strategies, multilateral arms control, nuclear proliferation and the potential contribution of confidence building measures, informal agreements, crisis control measures and third party initiatives to the arms control process.

- International Affairs 46.523F1 or W1

International Mediation and Problem-Solving

This seminar explores various approaches to the management and resolution of international economic, political and security conflicts. These approaches may include arbitration, conciliation and mediation as well as less formal mechanisms for third party consultation and collaborative problem-solving. The course focuses on the theory and practice of international conflict resolution, using cases drawn from a variety of issues and settings.

- International Affairs 46.527F1 or W1

Conflict in the Middle East

A critical examination of competing interpretations of conflicts in the Middle East region, including approaches to conflict resolution.

- International Affairs 46.529F1 or W1

Conflict in Southern Africa

A critical examination of competing interpretations of conflict in southern Africa, including approaches to conflict resolution.

- International Affairs 46.530F1

International Enterprise

This course is designed to give the student an appreciation of recent economic and political developments in the fields of international trade and investment as they

relate to the operations of international enterprises. The course will develop concepts and analytical approaches and provide examples in order to examine the impact of international enterprises on international affairs.

- International Affairs 46.531W1

International Industries

This course will develop a framework for describing and analyzing international industries. A number of industries will be examined. Issues to be discussed will include producer country associations, codes of conduct and guidelines, concession agreements and expropriations, country risk analysis and international collective bargaining.

- International Affairs 46.532F1 or W1

Science, Technology and International Affairs: The Advanced, Industrial Countries

This seminar analyzes the process of technological change since the industrial revolution and examines its consequences for development in the advanced industrial countries and for relations among these countries.

- International Affairs 46.533F1 or W1

Science, Technology and International Affairs: The Third World

This seminar focuses upon the problem of building indigenous technological capabilities in the Third World. It examines the role of MNCs in the transfer of technology, the generation of appropriate technologies locally and the role of the state in the formulation of technology policy for development. Technological cooperation among Third World countries may also be discussed.

- International Affairs 46.534F1 or W1

Agribusiness North and South

Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in advanced industrial societies and of their penetration into, and impact upon, Third World economies. (Also offered as Geography 45.558)

- International Affairs 46.535F1 or W1

International Bargaining and Negotiation: Theory and Practice

An examination of bargaining and negotiation in international economic, political and security issue areas, emphasizing case studies as well as theoretical analysis.

- International Affairs 46.536F1 or W1

The Third World in the Global System

The seminar examines the international relations of the Third World. It includes an analysis of relations within the Third World and with other segments of the global system. Topics may include human rights, leadership styles, and the role of ideology, and the global effects of industrialization, militarization, and war in the Third World.

• International Affairs 46.537W1

Macroeconomics in a Development Context

An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.

• International Affairs 46.538F1

International Economics: Policy and Theory

An overview of international finance, trade, investment, and international aspects of economic development. Emphasis will be placed on policy analysis and the underlying institutional context.

• International Affairs 46.539W1

International Financial and Monetary Institutions and Policy.

A selective, in-depth review of issues such as balance of payments, adjustment processes, and the role of international financial and monetary institutions.

• International Affairs 46.541F1 or W1

The International Economics and Politics of Resources
An examination of resource-related issues in the international system, focusing on energy, non-fuel mineral and agricultural areas.

• International Affairs 46.542F1 or W1

Territory and Territoriality

Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self-determination, conflict and processes of development. (Also offered as Geography 45.540)

• International Affairs 46.544F1 or W1

The Environment for International Management

Analysis of the international economic environment in which managers in the public and private sectors operate. The course examines the reasons for the growing inter-dependence of nations in terms of trade and investment, and the relationship of investment to trade in goods and services. Problems of management associated with this inter-dependence will be identified, together with an examination of the nature and effectiveness of emerging international rules and standards. *Prerequisite:* 46.538 or permission of the school.

• International Affairs 46.545F1 or W1

International Organizations in International Affairs

A critical analysis of the roles played by the United Nations and other international organizations in the fields of international conflict, development, and political economy.

• International Affairs 46.546F1 or W1

Policy Analysis and Evaluation

This seminar examines approaches to the development and implementation of the international public policies

of a number of countries, including Canada, in a variety of issue areas. The seminar focuses on case studies of economic, political, and security policy, and includes a consideration of organizational and systemic constraints on policy making as well as various concepts and methods for the evaluation of policy.

• International Affairs 46.549F1, W1, S1

Selected Topics in International Affairs

• International Affairs 46.555F1 or W1

International Law: Theory and Practice

This course is designed to give students an appreciation of various theoretical perspectives on international law, with a view to locating the role which international law plays in the international system. Topics considered include the basis of international law, the creation and sources of international law, the utilization of international law in international dispute-resolution, and international law and world order transformation. Illustrative issues will vary according to the interests of students each year. (Also offered as Law 51.563)

• International Affairs 46.557F1 or W1

International Economic Law: Regulation of Trade and Investment

A study of selected problems associated with the regulation of international economic activity. The seminars will focus on a discussion of relevant international institutions (GATT, UNCTAD, IMF, World Bank), an introduction to the legal aspects of integration (e.g. EEC, ASEAN), governmental regulation of trade and investment (e.g. FIRA), and the problem of extraterritoriality.

Prerequisite: Open only to graduate students in their master's year who have not previously studied international economic law.

(Also offered as Law 51.520)

• International Affairs 46.560F1 or W1

Human Resource Development

An analysis of theory and policy regarding some of the major areas of human development in the developing areas, including demography and population, education, public health, nutrition, women and development, social security, employment, and manpower planning.

• International Affairs 46.561F1 or W1

Historical Dimensions of Development and Underdevelopment

Comparative studies in the economic and social history of selected developed and developing countries. The aim is to identify conditions which have fostered or inhibited development in the past, and thereby to assess contemporary development strategies in the light of historical experience.

• International Affairs 46.563F1 or W1

Issues in Development in Africa

Analysis of structures and processes of political, social and economic change in intertropical Africa at scales

ranging from that of the local community to those of the nation state and international system. Alternative development policies and practices in rural and urban areas (including regional planning strategies) will be examined.

(Also offered as Geography 45.520)

• International Affairs 46.564F1 or W1

Issues in Development in Latin America

An examination of Latin America's principal developmental trends, problems and policies, as they have evolved during the past three decades. Emphasis will be given to the design and implementation of alternative development strategies through the remainder of the century.

• International Affairs 46.565F1 or W1

The Ethical Dimension of International Affairs

This course critically examines the ethical dimensions of development, global conflict, and international political economy. Subject matter includes beliefs and values, rights and obligations, and individual and state morality.

• International Affairs 46.567F1 or W1

Issues in Development in Southeast Asia

A comparative analysis of political and economic development in selected Southeast Asian countries, with particular attention to Indonesia, Malaysia, Thailand and Burma. Major issues to be studied include the process of political and social change, the emergence of contemporary economic systems, the evolution of development policies and planning and their impact on agriculture and rural development, education, industrialization and trade expansion.

• International Affairs 46.568F1 or W1

Indigenous Perspectives on Third World Development

This course examines some of the major perspectives and theories on Third World Development which have emerged from within the Third World. Included are authors representing structural, dependency and radical theories of development, as well as those who see development as psychological or spiritual liberation. Views of some of the leading political figures of the Third World are also considered.

• International Affairs 46.569F1 or W1

Social Cost-Benefit Analysis and Development Project Evaluation

An examination of social cost-benefit analysis and project evaluation in the context of the developing countries, emphasizing applied case studies as well as theoretical analysis.

• International Affairs 46.570F1 or W1

The Natural Ecosystem

An analysis of human involvement in the natural environment as an ecosystem in the development context. Material will discuss how the environment continues to be modified and the possible long term consequences in the light of rapid technological advances.

Special attention will be given to individual development projects including their political and social setting.

• International Affairs 46.571F1 or W1

Global Environmental Change: Human Implications

The nature of contemporary changes in global environmental systems and their significance for society, the economy and international relations. Phenomena such as climatic warming, deforestation, and the environmental pressures of urbanisation and intensive agriculture are analysed in terms of their regionally differentiated impacts and challenges for societal adaptation.

(Also offered as Geography 45.505)

• • International Affairs 46.580F1 or W1

Pacific Economic and Political Relationships

A course on the nature and prospects of the Pacific basin economy. The main topics will include a review of the record of outward-oriented development strategies of Japan, Korea, Taiwan, Hong Kong and ASEAN; the economics and politics of U.S.-Japan relations and the prospects of China's participation in Pacific trade and development. Canada's economic and political interests in Pacific co-operation will also be studied. Attention will be paid to the prospects for regional institutional arrangements as well as bilateral links.

• International Affairs 46.581F1 or W1

Regional Co-operation Among Developing Countries

A comparative study of selected regional co-operation or integration schemes, including some or all of the East African Community, the Economic Community of West African States, Central American Common Market, CARICOM, the Andean Group, and the Association of Southeast Asian Nations.

• International Affairs 46.582F1 or W1

The Political Economy of East-West Relations

Seminar designed to deepen students' understanding of the interaction of politics and economics in East-West relations. Topics include: the forms and impact of technology transfer, the role of multinationals, the problems of indebtedness, the effectiveness of controls and sanctions and the growth of energy interdependence. Special attention paid to Canada's position and experience in East-West relations.

• International Affairs 46.583F1 or W1

Political Economy of Eastern Europe

An examination of the Soviet-East European economic, political, ideological and military relations, of economic integration, of international relations in the region, and of the role of East-West co-operation.

• International Affairs 46.588F1 or W1

International Political Economy

A seminar on the changing international division of labour and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy.

Prerequisite: Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy (or permission of the school).

Note: Not open to students enrolled in 46.500.

(Also offered as Political Science 47.588)

- International Affairs 46.591F1, W1, S1

Tutorials in International Affairs

To be chosen in consultation with the director.

- International Affairs 46.595F1, W1, S1

Research Workshop

This seminar focuses on the special problems of research design in the interdisciplinary field of international affairs, with materials drawn from both the established literature and the practice of leading members of the school's faculty.

- International Affairs 46.598F2, W2, S2

Research Essay

- International Affairs 46.599F4, W4, S4

M.A. Thesis

Selection of Courses

In addition to the graduate courses offered in the school, qualified students may choose from among courses in international affairs offered by related departments, schools and institutes.

Department of Law

Loeb Bldg. C473
788-3690

The Department

Chair of the Department: C.N. Sargent

Director of the Jurisprudence Centre: C.N. Sargent

Although the Department of Law does not offer a program of studies leading to an M.A. degree in Law, it actively participates in such interdisciplinary graduate programs as those offered by the Norman Paterson School of International Affairs, the Institute of Canadian Studies, and the School of Public Administration. Members of the department also supervise graduate theses and research essays, and provide graduate-level tutorials dealing with the legal aspects of various disciplines.

The Jurisprudence Centre, established by the department in 1974, is a forum for the advanced interdisciplinary study of problems related to law, law reform, and policy.

Currently, the Department of Law offers six courses at the graduate level.

A number of courses offered by the department at the senior undergraduate level form part of certain interdisciplinary graduate programs in such areas as public administration, international affairs, Canadian studies, and Soviet and East European studies. These courses are described in the undergraduate calendar.

Graduate Courses*

• Law 51.510F1

Advanced Problems in Legal Philosophy
Studies in legal theory and analyses of law advanced by Hart, Dworkin, and others; legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term.

Prerequisites: Either Law 51.315, or 51.311 (32.311) and 51.312 (32.312), or permission of the department. (Also offered as Philosophy 32.510)

P.J. Fitzgerald and R.R.A. Marlin.

• Law 51.520W1

International Economic Law: Regulation of Trade and Investment

A study of selected problems associated with the regulation of international economic activity. The seminars will focus on a discussion of relevant international institutions (GATT, UNCTAD, IMF, World Bank), an introduction to the legal aspects of integration (e.g. EEC, ASEAN), governmental regulation of trade and investment (e.g. FIRA), and the problem of extraterritoriality.

Prerequisite: Open only to graduate students in their master's year who have not previously studied international economic law.

(Also offered as International Affairs 46.557)

P.J. Davidson.

• Law 51.550F1

The Canadian Constitution

A highly concentrated half-course, designed to familiarize graduate students with the terminology, principles, and doctrines of judicial interpretation of the *Constitution Acts 1867-1982* and other constitutional statutes. The emphasis will be on the division of legislative powers in the Canadian federation. This course or its equivalent is a prerequisite for the course Law 51.553: Advanced Legal Problems of Federalism.

Prerequisite: Open only to graduate students in their master's year who have not previously studied Canadian constitutional law.

J.G. Neuspiel.

• Law 51.553W1

Advanced Legal Problems of Federalism

An advanced study of selected Canadian constitutional problems including constitutional revision. Some comparisons with other federal systems may be made.

Prerequisite: A course in Canadian constitutional law, for example Law 51.550, or permission of the department.

J.G. Neuspiel and others.

• Law 51.563F1 or W1

International Law: Theory and Practice

This course is designed to give students an appreciation of various theoretical perspectives on international law, with a view to locating the role which international law plays in the international system. Topics considered include the basis of international law, the creation and sources of international law, the utilization of international law in international dispute-resolution, and international law and world order transformation. Illustrative issues will vary according

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

to the interests of students each year.

Prerequisite: Open only to graduate students in their master's year who have not previously studied international law. Graduate students at the qualifying year level might consider registering in Law 51.463, Public International Law.

(Also offered as International Affairs 46.555)

S.B. Boyd or M. Davies.

- Law 51.590T2

Tutorials/Directed Readings in Law

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor. A substantial requirement for the course may be participation in an advanced law course at the undergraduate level.

- Law 51.591F1, W1, S1

Tutorials/Directed Readings in Law

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor. A substantial requirement for this course may be participation in an advanced law course at the undergraduate level.

- Law 51.593F1 or W1 or S1

Selected Topics in Law

Topic varies from year to year.

Courses Not Offered in 1989-90

51.556 Advanced Administrative Law Problems

51.567 Advanced International Legal Problems

Department of Political Science

Loeb Bldg. B640
788-2764

The Department

Chair of the Department: J.H. Pammett
Departmental Supervisor of Graduate Studies:
P.C. Emberley
Assistant Supervisor: W.R. Newell

The department offers programs leading to the M.A. and Ph.D. degrees. Specialized graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration and policy analysis. Within these fields, students may select more specialized areas of concentration, such as classical, medieval and modern, or analytic and empirical theory; comparative government, and politics of a particular area or group of countries, such as Africa, Eastern Europe, or South and East Asia where the department has developed particular strength and resource materials.

Ottawa provides a wealth of resources, both in personnel and in research material, for the student of government, politics, public administration, and international relations. Carleton has specialized schools and institutes in interdisciplinary study in public administration, Canadian studies, international affairs, and Soviet and East European studies. In addition to the University facilities, Ottawa offers the graduate student in political science a host of study and research opportunities unparalleled in Canada. The Public Archives, the National Library, the Library of Parliament, the Supreme Court Library, the National Museums, and Statistics Canada are all located in Ottawa. The headquarters of many government departments, most federal government agencies, and a multitude of national organizations and trade associations are located in Ottawa; many maintain specialized libraries. Some of the embassies and diplomatic missions located in Ottawa maintain specialized libraries, and offer access to documents and other research materials.

Qualifying-Year Program

Applicants who have a general (pass) B.A. in Political Science, with second-class standing, may be considered for admission to a qualifying-year program. Candidates who complete the qualifying year with high honours standing may be considered for admission to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours B.A. (or the equivalent) in Political Science, with at least high honours standing.

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing. Those with deficiencies may be required to take additional courses or to register in the qualifying-year program.

Program Requirements

All master's candidates will enrol in an approved number of courses in political science, including political theory and research methodology, if not already taken. No more than one of these courses may be taken at the 400 level.

Each candidate, in consultation with the department, will select and follow one of the following three optional program patterns:

- Five full courses (or the equivalent) in political science
- Four full courses (or the equivalent) in political science, and a research essay on a topic related to one of the courses
- Three full courses (or the equivalent) in political science, and a research thesis, equivalent to two full courses, in an approved field.

All master's candidates in political science must also undertake comprehensive examinations on approved fields. Details of these examinations are outlined in the section on comprehensive examinations.

All candidates must normally demonstrate a reading knowledge of French. Students from abroad, whose mother tongue is other than English, or students whose research interests require another language, may obtain permission from the departmental graduate studies committee to substitute this language for French. Language tests are conducted twice a year, in October and February.

A supervisor will be appointed to each candidate to advise and assist in the preparation for the comprehensive and language examinations.

Comprehensive Examinations

Those master's candidates electing a five-course program will be required to take a comprehensive examination; orally or in writing, on an approved major and

allied field. The major field of concentration will be chosen from the following:

- Political Theory
- Canadian Government and Politics
- Comparative Government and Politics
- International Relations
- Public Administration and Policy Analysis

Comprehensive examinations normally will be undertaken no later than the term immediately following the completion of course work for the master's degree. Those master's candidates electing the four-course plus research essay, or three-course plus thesis options, will be required to defend the essay or thesis at an oral examination. This examination may include material related to the general field of the essay or thesis.

Academic Standing

All master's candidates must obtain at least B standing (grade point average of 8.0). One grade of C+ may be allowed.

Doctor of Philosophy

The Ph.D. program in political science normally will be undertaken on a full-time basis. However, in cases of exceptional merit, the department will accept a few candidates for the degree on a part-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or its equivalent) in political science, public administration, or international affairs, with at least high honours standing. This normally will mean a Carleton equivalent grade point average of 9.5, taking into account both transcript and letters of reference.

Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the general regulations section of this calendar.

All students are required to have or to acquire an adequate basic knowledge of political theory and research methodology, regardless of their field of specialization. Students in the integrated stream in public administration and public policy must have completed a suitable intermediate microeconomics course. If statistical proficiency is needed for the preparation of their thesis, students will also be expected to undertake further work in statistics.

The specific program requirements for Ph.D. candidates in political science are the following:

- At least three graduate full courses or the equivalent (four graduate full courses in the integrated stream in public administration); a grade point average of at least

9.0 must be obtained in these courses before proceeding to the comprehensive examinations. Additional courses may be required for candidates whose background or standing is deficient. Students are encouraged to take additional courses for credit or audit, beyond the minimum requirement of three (four in the integrated stream in public administration), in order to prepare for comprehensive examinations in areas of specialization in each of their fields.

- Program options for Ph.D. field selections (except for the integrated stream in public administration): *either* two major fields with two subfields in each, *or* a major field with two subfields and two minor fields with a subfield in each; that is, a choice of one of two program options: Political Science 47.690 and 47.695, *or* Political Science 47.690, 47.691, and 47.692.

- Proficiency in languages and/or research skills, as outlined below under language and research skill requirement

- Comprehensive examinations, as outlined below under comprehensive examinations

- A thesis, written in English or French, which must be defended in English at an oral examination; this examination may include material related to the general field of the thesis.

The completion of the Ph.D. course work and comprehensive examinations will normally require at least two years of full-time study beyond the master's degree.

Normally a thesis proposal will be submitted to and approved by members of the thesis committee within six months of the oral comprehensive examination.

A faculty member will be assigned to each Ph.D. candidate to advise him/her on his/her studies. The student's entire program must be approved by the department.

Language and Research Skill Requirement

All Ph.D. candidates must demonstrate an ability to use two research skills appropriate to their program, one of which must be a language other than English.

Candidates, one of whose major fields is Canadian government and politics, or whose thesis deals mainly with Canada, must demonstrate an ability to read and translate French easily as one of their skill requirements.

All other candidates must demonstrate an ability to read and translate easily a language appropriate to their program.

The second skill requirement for all students except those in the integrated stream in public administration may be fulfilled in one of the following ways:

- A demonstrated ability to read and translate easily a second language
- An oral knowledge of a language sufficient to conduct interviews in the language
- Satisfactory completion (B- or better) of *two* of Political Science 47.571: Intermediate Polimetrics for

Micro Data; Political Science 47.572: Intermediate Polimetrics for Macro Data; Political Science 47.573: Advanced Research Methods.

• Credit work in an approved political science methodology workshop or colloquium.

Students in the integrated stream in public administration, as their second research skill requirement, must complete satisfactorily (B- or better) Public Administration 50.524, Advanced Microeconomics for Policy Analysis; and one of 50.520, Public Sector Investment and Pricing, or 50.569, Public Choice: Theory and Application.

The research skill requirement shall *normally* be satisfied before the thesis proposal defence.

Comprehensive Examinations

All Ph.D. candidates must select one of the two options below:

• A written examination in two major fields covering general knowledge of the field; examination in two approved areas of specialization in each field, the form of examination to be determined by the supervisory committee in conjunction with the supervisor of graduate studies.

• A written examination in one major field covering general knowledge of the field, and examinations in two approved areas of specialization; a written general examination in two minor fields, and examination in one approved area of specialization in each. The form of examination in areas of specialization will be determined by the supervisory committee in conjunction with the supervisor of graduate studies.

In addition, candidates must undertake a final oral comprehensive examination integrating the fields.

The comprehensive examinations will normally be completed by the beginning of the seventh term of registration. Candidates will be expected to complete these examinations successfully before beginning the thesis. The fields of study for the Ph.D. examinations are to be chosen from the following list:

Political Theory

A general knowledge of the main outlines and significant themes and problems of political philosophy and thought, with emphasis on two of the following: classical (mainly Greek and Roman); medieval political thought; modern (from the sixteenth century); political ideologies (nineteenth and twentieth centuries); Canadian and American political thought and its immediate European background (if Canadian political thought and ideology is not chosen as a subfield under Canadian); current theories and approaches to political analysis; quantitative theory and method.

Canadian Government and Politics

A general knowledge of Canadian political ideas, institutions, and processes, with emphasis on two of the following: federalism and the constitution; parliament and legislatures; parties, elections, and interest groups;

political culture and socialization; political economy; provincial government and politics; local government and politics; public administration (if not chosen as a subfield under public administration and policy analysis); public policy and policy analysis (if not chosen as a subfield under public administration and policy analysis); foreign policy and relations (if Canada is not chosen as the particular state under international relations); Canadian political thought and ideology (if not chosen as a subfield under political theory).

Comparative Government and Politics

A general knowledge of the theories and methodology of comparative politics, with emphasis on one subfield from each of the following two lists:

• Countries or areas: Western Europe; USSR and/or Eastern Europe; United States; Africa; Asia; or an approved combination of countries or areas.

• Topics or themes: the state and society; institutions; development; revolution and social movements; nationalism; politics of multiculturalism and ethnicity; political behaviour; federalism; local government and politics; gender and politics; or an approved topic or theme.

• International Relations

A general knowledge of international theory, international organization, and the development of the field of international relations, with specialization in two of the following: analytical international theory; Canadian foreign policy (if this subfield is not chosen in Canadian government and politics); comparative analysis of foreign policy (including a knowledge of a particular state or region); international integration and organization; conflict and conflict resolution (including arms control and international negotiation); international political economy.

Public Administration and Policy Analysis

(a) General Stream.

A general knowledge of theory and practice with emphasis on two of the following topics: 1. theories of administration, organization, comparison, and policy analysis; 2. Canadian public administration (including some knowledge of provincial and municipal levels); 3. Canadian public policy and policy analysis (including some knowledge of provincial and municipal levels); 4. comparative public administration (with reference to developed or developing countries, or an approved combination of countries); 5. comparative public policy and policy analysis (with reference to developed or developing countries or an approved combination of countries); 6. administrative responsibility (including judicial controls).

Candidates may not select both subfields 2 and 3 and may not select any of subfields 2, 3, or 4 in combination with the corresponding subfields in the main fields of Canadian Government and Politics and Comparative Government and Politics. For example, a candidate may not select the Canadian subfield "public administration" and the Public Administration subfield "Canadian public administration".

(b) Integrated Stream.

An integrated knowledge of theory and practice with emphasis on theories, policy analysis and evaluation, and Canadian and comparative public policy and administration.

The integrated stream consists of a major field and two minor fields. The major field is public administration and policy analysis, with the following two subfields: 1. theory of administration, organization and policy, and 2. policy analysis and evaluation. The two minor fields are: 1. Canadian government and politics, and 2. comparative government and politics, with one approved subfield in each.

Students are normally required to complete six half-courses in their major field and at least one half-course in each minor field.

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the *Carleton University Undergraduate Calendar*) may be taken by graduate students.

Please note that not all of these courses are offered every year. Students should consult the timetable published each year in early June.

Political Science

- 47.400 Topics in Canadian Government and Politics
- 47.401 Canadian Public Policy
- 47.402 Policy Seminar: Problems of Northern Development
- 47.403 Politics and the Media
- 47.404 Interest Groups in Canadian Politics
- 47.405 Federalism
- 47.406 Legislative Process in Canada
- 47.407 The Politics of Law Enforcement in Canada
- 47.408 National Security and Intelligence in the Modern State
- 47.409 Politics in Quebec
- 47.410 Canadian and Comparative Local Government and Politics
- 47.411 French-English Relations
- 47.412 Politics of Liberal Democracies
- 47.413 The State in Advanced Capitalist Societies
- 47.414 Theory and Practice in Third World Development
- 47.415 Selected Problems in Third World Development
- 47.420 Policy Making in the United States
- 47.421 Politics of Influence in the United States
- 47.422 Constitutional Politics
- 47.430 Concepts of the State
- 47.431 Marxist Thought
- 47.432 Contemporary Marxism
- 47.434 Political Inquiry
- 47.435 Contemporary Political Theory

- 47.440 Comparative Public Administration
- 47.441 Business-Government Relations in Canada
- 47.446 Theories of Public Administration
- 47.447 Decision Theories and Policy Studies
- 47.448 Public Organizations: Theory and Practice
- 47.460 Analysis of International Politics
- 47.461 Soviet Foreign Policy
- 47.463 Analysis of International Political Economy
- 47.464 Selected Problems in International Political Economy
- 47.466 American Foreign Policy
- 47.467 International Politics of North America
- 47.471 Intermediate Polimetrics for Micro Data
- 47.472 Intermediate Polimetrics for Macro Data
- 47.482 International Politics of Africa
- 47.483 Foreign Policies of Major East Asian Powers

Students are encouraged to look at the course offerings of the Departments of Sociology and Anthropology, and Economics; the Schools of International Affairs, Journalism, Public Administration, and Social Work; and related disciplines at Carleton.

Except where an M.A. student is permitted to take an allied field in another discipline, a graduate student will normally take no more than one course in another department, school, or institute, in fulfilment of the M.A. or Ph.D. requirements.

Graduate Courses*

The following is a complete list of all political science graduate-level courses. Students should consult the timetable (published in early June) for a list of courses which will be offered during 1989-90.

Enrolment in graduate courses requires the permission of the department, through the supervisor of graduate studies.

- Political Science 47.501F1 or W1
Canadian Provincial Government and Politics
A research seminar on selected problems.
Prerequisite: Political Science 47.200 or 47.201 or permission of the department.
- Political Science 47.503F1 or W1
Political Parties in Canada
A seminar on political parties and party systems in Canadian federal politics, including an examination of patterns of historical development, party organization and finance, relationships with social movements, and the impact of Canadian federalism.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Political Science 47.504F1 or W1
Policy Making in Canada

A study of the main policy-making actors, structures, and influences at the federal level, such as the cabinet, the bureaucracy, the central and advisory agencies, parliament, parties, interest groups, élites, secrecy and the press. Some attention will also be given to the provincial level and to the process of federal-provincial bargaining.

• Political Science 47.506F1 or W1
Problems of Canadian Government and Politics I
A research seminar on selected problems.

• Political Science 47.507F1 or W1
Problems of Canadian Government and Politics II
A research seminar on selected problems.

• Political Science 47.508F1 or W1
The Politics of Energy and the Environment
A research seminar focusing upon the substantive issues, the policy structures and processes, and current Canadian governmental response in the area of energy policy and environmental quality management.

• Political Science 47.509F1 or W1
Canadian Political Economy
A seminar on political economy as a traditional and contemporary approach to the study of Canadian politics. The theoretical bases of this approach will be discussed, as will the controversies generated in its examination of the relationship between the Canadian state and international and domestic capitalism. Specific topics will range from the staple thesis and the national policy, to the hinterland perspective on Western Canada, and to the contemporary literature on dependency, class, and state.

• Political Science 47.511F1 or W1
Canadian Federalism
A study of the evolution and contemporary operation of the Canadian federal system, noting particularly the specific social, political, economic, and structural features which underlie its operational performance, its resilience in crisis, and its potential for adaptation.

• Political Science 47.514F1 or W1
Comparative Communist Politics: Theory and Practice
Examination and analysis of basic models of communist political systems, with emphasis on problems of systemic change and adaptation (inclusive of Soviet, East European and Asian systems, and Cuba).
Prerequisites: Political Science 47.320 and either 47.215 or 47.312, or permission of the department.

• Political Science 47.515F1 or W1
Comparative Communist Politics: Selected Aspects
Examination and analysis of selected aspects of communist political processes, such as integration, élite formation, leadership and succession, and decision making. The emphasis will change from year to year.
Prerequisite: Political Science 47.514 or permission of the department.

• Political Science 47.516F1 or W1
Selected Problems in Soviet Politics
A seminar on selected aspects of the Soviet political system, with special attention to the inter-relationship among politics, culture, and society in the USSR.
Prerequisites: Political Science 47.100, 47.320 and 47.432, or permission of the department.

• Political Science 47.517F1 or W1
Selected Problems in African Politics
A political economy approach will be taken in this seminar, stressing the relationship of dependence, underdevelopment, participation, and class formation to the decision-making process in selected countries.

• Political Science 47.518F1 or W1
State, Revolution, and Reform in East Asia
Problems of state-building, political institutions, and policy making in the sinitic world, including the People's Republic of China, Taiwan, Japan, North and South Korea, and Vietnam.
Prerequisite: Political Science 47.312 or permission of the department.

• Political Science 47.519F1 or W1
Comparative Public Policy
A review of approaches to the study of policy, of the impact of political factors on policy, and of the substance of policy choices in such domestic fields as communications, social security, health, industrial and rural development policies in selected countries.

• Political Science 47.520F1 or W1
Nationalism
A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

• Political Science 47.521F1 or W1
Politics in Plural Societies
A seminar on politics in multicultural societies, with emphasis on Canada and other developed democracies. Topics will include structural segmentation, consociational processes, intergroup attitudes, and institutional adjustments to pluralism.

• Political Science 47.525F1 or W1
Problems in American Government I
A research seminar on topics such as the distribution of power, decision-making processes, the impact of technology, strains in intergovernmental relations, civil-military relations, governmental news management and secrecy; executive accountability, and impediments to reform of Congress and the presidency.

• Political Science 47.526F1 or W1
Problems in American Government II
A research seminar on topics such as political violence and social change, the roles of mass media, business élite roles, political corruption, civil rights and minority politics, and the urban crisis.

• Political Science 47.531F1 or W1
Modern Political Culture and Ideology

A theoretical investigation of leading themes in modern political culture: nature and civilization, immanence and transcendence, nihilism and reason, myth and history, magic and technology, the group and the individual.

• Political Science 47.532F1 or W1
Democratic Theories

Analysis of various democratic theories, from classical to modern, including a contemporary democratic theory of labour-managed systems applicable to welfare, liberal, and socialist states.

• Political Science 47.536F1 or W1

The Canadian and American Political Traditions I

A seminar on the interpretation of the American, English-Canadian, and French-Canadian political traditions. The emphasis will be on English-Canadian and French-Canadian political traditions. Students who have completed 47.535 may not take 47.536 for credit.

• Political Science 47.537F1 or W1

The Canadian and American Political Traditions II

A seminar on the interpretation of the American, English-Canadian, and French-Canadian political traditions. The emphasis will be on the American political tradition. Students who have completed 47.535 may not take 47.537 for credit.

• Political Science 47.541F1 or W1

Canadian Public Administration and Policy Analysis
The theory and practice of public administration in Canada, with emphasis on the federal level, including the role of the bureaucracy in policy making.

• Political Science 47.544F1 or W1

Public Administration in Developed Western Countries
A seminar in comparative public administration, with emphasis on Commonwealth countries, the United States, France, and West Germany.

• Political Science 47.545F1 or W1

Public Administration in Developing Countries

A seminar on the literature and characteristics of development administration; comparison by region, country, and topic.

• Political Science 47.548F1 or W1

Research Seminar in Public Administration I

The content of this seminar will vary from year to year according to faculty research interests and student demand.

• Political Science 47.549F1 or W1

Research Seminar in Public Administration II

The content of this seminar will vary from year to year according to faculty research interests and student demand.

• Political Science 47.551S1

Selected Problems in Political Economy I

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

• Political Science 47.552S1

Selected Problems in Political Economy II

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

• Political Science 47.553F1 or W1

Selected Problems in Western European Politics I

This course is designed to deal intensively with domestic politics in Britain, France, Germany, Italy, and selected minor European powers. Students who have completed 47.550 may not take 47.553 for credit.

• Political Science 47.554F1 or W1

Selected Problems in Western European Politics II

This course is designed to deal intensively with comparative and supra-national issues concerning the European Community, NATO, and other Western European institutions. Students who have completed 47.550 may not take 47.554 for credit.

• Political Science 47.555F1 or W1

Selected Problems of Comparative Politics I

A research seminar which will deal with a central theme of current research in comparative politics, such as: the effects of state policy and expenditure; technology and politics; political psychology; sex/gender and politics; the military and politics; Marxism and politics; religion and politics; studies in revolution; comparative parties and interest groups.

• Political Science 47.556F1 or W1

Selected Problems of Comparative Politics II

A research seminar which will deal with a central theme of current research in comparative politics, such as: the effects of state policy and expenditure; technology and politics; political psychology; sex/gender and politics; the military and politics; Marxism and politics; religion and politics; studies in revolution; comparative parties and interest groups.

• Political Science 47.561F1 or W1

Analysis of Canadian Foreign Policy

A research seminar on contemporary Canadian external policies, with emphasis on the analysis of cases and issues, and comparisons with other national actors.

Prerequisites: Political Science 47.260 and 47.366, or permission of the department.

- Political Science 47.570F1 or W1

Basic Research Methods

A course for graduate students with no background in research methods. Content: basic statistics and applications.

- Political Science 47.571F1 or W1

Intermediate Polimetrics for Micro Data

This course covers intermediate research designs and statistical techniques primarily used in analysing survey data. Selected topics may vary from year to year. Students intending to do research based on micro data are advised to take this course.

Prerequisite: Political Science 47.570 or permission of the department.

- Political Science 47.572F1 or W1

Intermediate Polimetrics for Macro Data

This course covers intermediate research designs and statistical techniques primarily used in analysing macro or aggregate data. Selected topics may vary from year to year. Students intending to do research based on macro data are advised to take this course.

Prerequisite: Political Science 47.570 or permission of the department.

- Political Science 47.573F1 or W1

Advanced Research Methods

A course in advanced techniques of analysis. The focus of this research seminar is the use of various mathematical and statistical techniques in the construction and analysis of political theory. The seminar may include such topics as the translation of verbal theory into formal theory, the use of statistical techniques beyond regression and correlational analysis to examine political hypotheses, and index construction, including scaling and validation techniques.

Prerequisite: Political Science 47.570 or permission of the department.

- Political Science 47.581F1 or W1

Foreign Policies of African States

The foreign policy determinants and international behaviour of African states. Each year, the seminar will focus on a particular issue area.

- Political Science 47.585F1 or W1

Foreign Policy Analysis

A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.

Prerequisite: Political Science 47.460 or permission of the department.

- Political Science 47.586F1 or W1

Strategy

A research seminar on the analysis of recent Western as well as Soviet and Chinese strategic concepts, civilian-military relations, defence policy, decision making, and arms control and disarmament.

- Political Science 47.587F1 or W1

Analysis of International Organization

A research seminar on process and change in contemporary forms of international organization.

Prerequisite: Political Science 47.360 or permission of the department.

- Political Science 47.588F1 or W1

International Political Economy

A seminar on the changing international division of labour, and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy.

Prerequisite: Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy (or permission of the department). (Also offered as International Affairs 46.588)

- Political Science 47.589F1 or W1

Problems in International Politics

A workshop on significant issues in the study of international politics, with emphasis on the state of the field (and subfields) and problems in research.

Prerequisite: Political Science 47.560 or 47.660 and 47.661, or permission of the department.

- Political Science 47.590T2

Tutorial in a Selected Field

Tutorials or reading courses on selected topics may be arranged with the permission of the department.

- Political Science 47.591F1, W1, S1

Tutorial in a Selected Field

Tutorials or reading courses on selected topics may be arranged with the permission of the department.

- Political Science 47.594F1, W1, S1

M.A. Comprehensive Tutorial

Tutorial designed as preparation for the M.A. comprehensive examination, under the direction of members of the department. The grade to be awarded will be that obtained on the comprehensive examination.

- Political Science 47.598F2, W2, S2

M.A. Research Essay

Tutorial for students who write a research essay rather than a thesis.

- Political Science 47.599F4, W4, S4

M.A. Thesis

- Political Science 47.600F1

The Political Process in Canada I

An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada. Students who have completed 47.510 may not take 47.600 for credit.

• Political Science 47.601W1

The Political Process in Canada II

An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada. Students who have completed 47.510 may not take 47.601 for credit.

• Political Science 47.615F1

Comparative Government I

A research seminar dealing with theories, methods, and problems of comparison. Students who have completed 47.505 may not take 47.615 for credit.

• Political Science 47.616W1

Comparative Government II

A research seminar dealing with particular themes. Students who have completed 47.505 may not take 47.616 for credit.

• Political Science 47.630F1

Political Theory I

An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth. Students who have completed 47.530 may not take 47.630 for credit.

• Political Science 47.631W1

Political Theory II

An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth. Students who have completed 47.530 may not take 47.631 for credit.

• Political Science 47.646F1

Theories of Public Administration

A seminar on theories of bureaucracy, organization, and comparison. Students who have completed 47.546 may not take 47.646 for credit.

• Political Science 47.647W1

Decision Theories and Policy Studies

This course will cover decision making and policy studies in a non-mathematical way from two complementary angles: basic philosophy, psychology, and theory of individual and group decision making; and overall policy analysis as pursued by Vickers, Dror, and others, with a brief look at tools of decision making. Students who have completed 47.547 may not take 47.647 for credit.

• Political Science 47.660F1

Theory and Research in International Politics I

An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.

Prerequisite: Political Science 47.460 or permission of the department.

Students who have completed 47.560 may not take 47.660 for credit.

• Political Science 47.661W1

Theory and Research in International Politics II

An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.

Prerequisite: Political Science 47.460 or permission of the department.

Students who have completed 47.560 may not take 47.661 for credit.

• Political Science 47.690F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examination.

• Political Science 47.691F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examinations.

• Political Science 47.692F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examinations.

• Political Science 47.695F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examination.

• Political Science 47.699F10, W10, S10

Ph.D. Thesis

Ph.D. students in political science at Carleton University may also seek supervision from the faculty of related schools and departments, particularly the School of Public Administration, the Norman Paterson School of International Affairs, the School of Journalism, and the Departments of Economics and Sociology and Anthropology.

Department of Psychology

Loeb Bldg. B552
788-2647

The Department

Chair of the Department: W.D. Jones
Departmental Supervisor of Graduate Studies:
D.C. McIntyre

The Department of Psychology offers programs of study and research on a full-time and part-time basis, leading to the degrees of Master of Arts and Doctor of Philosophy. Financial support is available, but is limited to full-time students.

There is a very close link in the Department of Psychology between graduate studies and research. Research in the department is distributed across the life sciences areas of biopsychology, animal learning, perception, and cognition, and across the social sciences areas of social and developmental psychology. Its research and graduate program in biopsychology is one of the strongest in Canada, with current research focusing on problems of the neurochemistry of stress and learning; developmental psychopharmacology; experimental models of epilepsy; neuroanatomy; brain lateralization; neural mechanisms of audition; drug dependence; and the effects in animals and humans of prenatal alcohol and drug exposure on postnatal behaviour. The department has related human neuropsychological research activities dealing with alterations to visual and auditory psychophysical functions associated with neuropathological conditions; determinants, correlates, and treatment of hyperactivity in children; and the relation of behavioural, psychological, and electrophysiological variables to sleep and dreaming states. Within the social sciences realm, a unique laboratory has been developed for the study of hypnosis, approached experimentally from social psychological, perceptual, and cognitive perspectives provided, in part, by other on-going research programs in the department. In recent years, there has been a growth of activity in aspects of applied psychology, including evaluation research; corrections; education; impact of computer and telecommunications technology; behavioural medicine; and psychological assessment. This has fostered close collaborative contacts between the department and public service and applied settings in Ottawa, such as the Children's Hospital of Eastern Ontario, the Royal Ottawa Hospital, the National Research Council, Department of Communications (Canada), Ontario Ministry of Correctional Services, and the Ottawa Board of Education. Practica and internships are available in many of these settings to students at the doctoral level.

Because of the breadth of interests in the department, there is an emphasis in graduate courses on

methodological and conceptual issues that are applicable across research specializations. Consequently, most substantive courses, regardless of title, are relevant to most students' programs. Students typically work very closely with their advisers who, through informal tutorials and directed studies and independent research courses, provide much of the opportunity for specialized study. Applicants are strongly encouraged to write directly to faculty members for more specific details on research interests and programs currently underway.

As part of its general experimental program, the department provides the opportunity to pursue a concentration at the doctoral level in behavioural neuroscience (a collaborative endeavour with the University of Ottawa), human neuropsychology, or human information systems. Applicants should consult with the supervisor of graduate studies for information on structuring a doctoral program of studies within a concentration.

Through a quantitative methods requirement, completion of a demanding empirical thesis presented and defended orally, participation in small seminars, and a close relationship with faculty advisers and students, the M.A. program provides the opportunity for a refinement of critical, logical, and analytical skills; skills of written and oral expression; understanding of the strengths and limitations of the scientific method as a means of problem solving, demonstrated through psychology but applicable to issues in society at large; an understanding of quantification and scaling, the use of statistical methods and inference, and the use of evidence to support argument. For some students this is a satisfactory and satisfying end in itself. For others, it provides a solid preparation for the doctoral program in which original independent study and research is stressed. The department does not distinguish between an applied and an experimental program; instead, the basic orientation is experimental and theoretical, but with opportunities, where appropriate, to provide complementary experience necessary to work successfully as a psychologist in applied research/service settings.

Augmenting the well-equipped laboratories expected in an active research environment, the Department of Psychology receives excellent technical support from the Carleton University Science Technology Centre, where design and manufacture of special-purpose apparatus is carried out. In addition, the workshops provide technical support for the more than 25 computer systems currently in use in laboratories throughout the department.

Graduate students have access to the Xerox Sigma 9 and Honeywell Level 66 computer systems, supported by the Computing Services division of the University.

These systems support a variety of computer languages, including FORTRAN, APL, PASCAL, and BASIC, several microcomputer emulatory programs, a variety of statistical and mathematical packages, such as the BMDP and SPSS systems, and many other programs.

In fulfilling degree credit requirements, all graduate students are required to demonstrate competence in statistical and quantitative methods through successful completion of Psychology 49.540 (with a grade of B- or better) or a qualifying examination. This is ordinarily scheduled during the first part of September, just prior to the registration period, and it encompasses the material covered in Psychology 49.540. In the event of successful completion of the examination, another course is substituted for Psychology 49.540. In the case of M.A. students, the department may recommend that a grade of C+ in Psychology 49.540 be accepted for credit (see page 19 of the general regulations) only after successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

In addition to fulfilling the remaining credit requirements as described in subsequent sections, all graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each year, the candidate's adviser submits a written critique of research progress, and this becomes part of the candidate's permanent record. Qualifying-year students are evaluated at the end of the first 12 months.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

The department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work, research, or comprehensive examinations proves unsatisfactory.

Qualifying-Year Program

Occasionally, candidates with exceptional promise who offer less than honours B.A. status may be admitted to a qualifying-year program, approved by the graduate studies committee, and designed to prepare them for master's study. A minimum grade of B- must be obtained in each qualifying-year course, and candidates may be required to complete satisfactorily the equivalent of an honours B.A. thesis.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an Ontario honours B.A. (or its equivalent) with high honours standing and with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; and history and/or systems.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

The deadline for submitting applications for graduate study in psychology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

Program Requirements

The master's program usually consists of three full courses (or the equivalent), of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to two full courses) which must be defended at an oral examination. Psychology 49.540, or the successful completion of the opting-out examination in quantitative methods, is required of all graduate students. Course credit will not be given for successful completion of the opting-out examination.

Master of Science

In conjunction with the Ottawa-Carleton Specialization in Neuroscience, the Department of Psychology offers the M.Sc. degree. The candidate must fulfill the normal program requirements listed above together with the requirements of the Specialization (see page 203).

Academic Standing

A grade of B- or better is normally required in each of the courses counted for credit towards the M.A. degree. The department is prepared on occasion to recommend to the dean that a candidate be allowed a grade of C+ in one full course or each of two half-courses. In the case of Psychology 49.540, such a recommendation will be based on successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

Doctor of Philosophy

Admission Requirements

The requirements for admission to the Ph.D. program are outlined in the general section of this calendar. Scores on the Graduate Record Examination are also optional.

The Ph.D. program in psychology normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the department will accept a few candidates for the degree on a part-time basis. A Ph.D. candidate who enters the part-time program will normally be required to be registered as a full-time student for a minimum of three terms, at least two of which are consecutive. The time limit for completion of Ph.D. degree requirements for those who enter the program on a part-time basis will be the same as for those who enter on a full-time basis and subsequently register for part-time study; that is, eight calendar years. (See Time Limits, page 22).

Applicants should note that of the B.A., M.A., and Ph.D. degrees in Psychology, only two may ordinarily be taken at Carleton University.

Program Requirements

The minimum program requirements for the Ph.D. degree in Psychology are as follows:

- 10 full-course credits, with a minimum grade of B- in each course
- Psychology 49.540, its equivalent, or the successful completion of the opting-out examination in quantitative methods, and two of Psychology 49.541, 49.542, 49.543, 49.546 are required of all graduate students. In the case of success in the opting-out examination in quantitative methods, another course is substituted for 49.540.
- A thesis equivalent to four of the required 10 full-course credits will be required for concentration in the history of psychology. Ordinarily, in the other areas of psychology, the thesis will be offered in fulfillment of five of the required 10 credits.

All Ph.D. candidates are required to submit a thesis prospectus. The prospectus examination must be successfully completed within seven calendar terms of the student's initial registration in the Ph.D. program.

Comprehensive Examinations

All Ph.D. candidates in Psychology are required to pass a written and an oral examination on a topic distinct from the topic of the thesis. The topic of the Comprehensive Examination shall be approved by the Graduate Studies Committee of the Department of Psychology. There are two optional forms for the written and the oral examination: either a major essay or a research grant proposal. The submission of the written portion of the examination will be followed within one to three weeks by a comprehensive oral

examination, which is not restricted to issues raised by the written portion.

Ordinarily the Comprehensive Examination must be completed successfully before the Ph.D. prospectus meeting is scheduled. The oral defense must occur within four calendar terms of the student's initial registration in the Ph.D. program.

Graduate Courses*

• Psychology 49.510F1

Research Methods in Social Psychology I

Experience with research and data analysis techniques of particular relevance for social psychology, such as sampling, attitude scaling, and measurement. Normally required of students writing a thesis in social psychology.

• Psychology 49.511W1

Research Methods in Social Psychology II

Current ethical and methodological issues in social psychological research, such as experimental effects, deception, and subject variables. Normally required of students writing a thesis in social psychology.

• Psychology 49.515F1

Fundamentals of Computing for Psychologists

A survey of computer and communication hardware and software. The purpose of the course is to make psychologists aware of the concepts and terminology used by engineers and programmers in planning computer applications; it is not designed to train students to be programmers or to build equipment. The course will have a weekly laboratory.

Prerequisite: One course in computer programming.

• Psychology 49.516F1

Applications of Computers to Thinking, Problem Solving, and Decision Making

A survey of literature in such fields as artificial intelligence, database management, computer-aided instruction, simulation and forecasting, and computer-mediated communication. Psychological principles in the design, use, and evaluation of these cognitive aids will be stressed.

Prerequisite: Psychology 49.515.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Psychology 49.520T2 (PSY6201)

Basics of Neuroscience

A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology.

(Also offered as Biology 61.534T2)

- Psychology 49.530W1

Perceptual Processes

Theoretical and empirical issues and implications of the area of perception, with attention to psychophysics, information processing, physiological mechanisms, and the ontogeny of perception.

- Psychology 49.540F1

Quantitative Psychology I: Univariate Techniques

Applications of the general linear model including analysis of variance and multiple regression: prediction and estimation. Extensive use is made of computer statistical packages.

- Psychology 49.541W1, S1

Quantitative Psychology II: Multivariate Techniques

Applications of multivariate statistical techniques with psychological data including multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor analysis. Extensive use is made of computer statistical packages.

Prerequisite: Psychology 49.540.

- Psychology 49.542W1, S1

Descriptive and Nonparametric Statistics

An overview of methods for assisting in the detection and explanation of patterns in data that do not satisfy parametric test assumptions. Topics may include exploratory data analysis, information analysis, prediction analysis, ordinal pattern analysis, and conceptual issues in statistics.

Prerequisite: Psychology 49.540.

- Psychology 49.543W1, S1

Measurement and Scaling: Theory Methods and Applications

An examination of the various fundamental measurement and derived measurement and scaling systems encountered in the social and behavioural sciences. Theoretical foundations and applications of extensive, conjoint, difference, utility and subjective probability, similarity and preference systems are studied. Multidimensional scaling of similarities and preference data is emphasized as is use of the available computer based routines.

Prerequisite: Psychology 49.540.

- Psychology 49.546W1, S1

Quasi-experimental Design and Evaluation Research Coverage of methodological and statistical problems occurring in field settings and program evaluations.

Prerequisites: Psychology 49.540 and one of 49.541, 49.542, or 49.543.

- Psychology 49.547F1

Tests and Measurements

The administration and use of representative psychological tests.

Prerequisite: Psychology 49.380 or its graduate equivalent when offered.

- Psychology 49.551F1

Developmental Psychology I

A detailed examination of selected issues in developmental psychology.

- Psychology 49.552W1

Developmental Psychology II

A continuation of 49.551.

- Psychology 49.561W1

Contemporary Research in Personality

Current controversial issues in personality research, and selected theoretical and research studies in personality.

- Psychology 49.570F1

Research Methods in Learning

Methods, research design, and instrumentation in the fields of learning and retention, with emphasis on response definition and measurement, procedures for monitoring the learning process, and problems of control.

- Psychology 49.573W1

Human Learning

A discussion of selected topics within the area of human learning.

- Psychology 49.575F1

Behaviour Modification I

The basic principles of learning as they apply to the modification of behaviour, with emphasis on application, ethics, research, and methodology.

- Psychology 49.576W1

Behaviour Modification II

Special problems, topics, and projects related to behaviour modification.

Prerequisite: Psychology 49.575.

- Psychology 49.580F1, W1, S1

Special Topics in Psychology

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

- Psychology 49.590F1, W1, S1

Directed Studies

An investigation in depth of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the graduate committee. A final report must be filed in the departmental office prior to submission of course grade.

- Psychology 49.591F1, W1, S1

Independent Research

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

- Psychology 49.599F4, W4, S4

M.A. Thesis

- Psychology 49.600F1

Systems of Psychology

Historical research methods on the study of psychological movements and problems of the late nineteenth and early twentieth centuries; may be repeated for credit.

(Open with permission to advanced undergraduates)

- Psychology 49.601W1

Problems in the History of Psychology

A study of one or more selected topics in the history of man's attempt to understand his own nature; may be repeated for credit.

(Open with permission to advanced undergraduates)

- Psychology 49.603F1

Observation, Description, and Explanation in Psychology

Problems of communication, concept formation, and exploration in the biosocial sciences are discussed. The interplay of facts, methods, models, theories, and the human values which these serve are also explored.

- Psychology 49.610F1

Research Seminar in Social Psychology I

- Psychology 49.611W1

Research Seminar in Social Psychology II

- Psychology 49.612F1

Experimental Hypnosis

Selected issues in the study of experimental hypnosis will be critically reviewed. The problem of hypnotic susceptibility and its correlates will be given particular attention. Relationships among hypnotic phenomena, meditation, and behaviour therapy will be evaluated.

- Psychology 49.615F1

Psychological Aspects of Computer Use

An investigation of human factors related to the effective design of computer hardware and software. Topics may include the design and evaluation of information search procedures, graphic displays, and operation manuals on the assessment of useability. A research project will be required.

- Psychology 49.616W1

Social Aspects of Computer Use

An investigation of the social psychological and political factors affecting the adoption and use of computers. Topics may include the design and evaluation of training programs, the assessment of attitudes towards

computers, threats to privacy and jobs, and computer crime. Emphasis will be placed upon the organizational and interpersonal changes resulting from the introduction of computers into work settings. A research project will be required.

- Psychology 49.620T2

Advanced Seminar in Neuroscience

An advanced seminar course integrating various aspects of neuroscience.

(Also offered as Biology 61.632T2)

Prerequisite: Psychology 49.520 or 49.623

- Psychology 49.623T2 (ANA5470, PHS5470)

Neuroanatomy and Neurophysiology

An integrated course on the central nervous system given by the departments of Anatomy and Physiology of the University of Ottawa and their invited lecturers.

- Psychology 49.624F1 (ANA7400 Fall Term)

Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department.

(Also offered in Biology 61.623F1)

- Psychology 49.625W1 (ANA7400 Winter Term)

Neuroscience Techniques II

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department. The supervisor must be different from that of 49.624F1.

(Also offered in Biology 61.624W1)

- Psychology 49.626F1

Comparative Psychology

Varied and acquired adaptive mechanisms and their phylogenesis. Topics will include attachment behaviour, social organization, learning abilities, communication, and motivation.

- Psychology 49.650F1

Research Seminar in Developmental Psychology I

- Psychology 49.651W1

Research Seminar in Developmental Psychology II

- Psychology 49.661F1

Seminar in Human Neuropsychology I

A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

- Psychology 49.662W1

Neuropsychological Assessment

Review of the rationale and practice of diagnosis and treatment based on neuropsychological test results. The reliability and validity of test batteries such as the Halstead-Reitan and the Luria-Nebraska are studied. A variety of methods of test interpretation are utilized

in clinical analysis of patient protocols, including degenerative diseases, psychiatric disorders, seizures, head injury, and brain tumors.

Prerequisite: Psychology 49.661.

- Psychology 49.663F1

Seminar in Human Neuropsychology II

(Same description as 49.661)

- Psychology 49.664W1

Theories of Brain Dysfunction in Psychopathology

A review of neuropsychological theoretical explanations and empirical findings regarding brain functioning in a variety of organic and psychiatric disorders, such as autism, schizophrenia, minimal brain dysfunction, anorexia nervosa, aphasia, and memory disorders. These disorders are examined from neurological, psychological, biochemical, and neuropsychological points of view.

Prerequisite: Psychology 49.661.

- Psychology 49.665F1

Comparative Neuropsychology

An examination, from a comparative perspective, of research and logic associated with the study of brain-behaviour relations. The objective of the course is to provide a background and orientation for evaluating infra-human research of brain-behaviour relations, and for relating such research to problems of human neuropsychology.

- Psychology 49.666W1

Human Communication Disorders

The course provides an overview of normal and abnormal functions of the auditory system, particularly as it relates to the perception of human speech sounds. Diagnosis of clinical syndromes will be covered.

- Psychology 49.667W1

Developmental Psychopharmacology

The synthesis and metabolism of various neurotransmitters are detailed with respect to their role in behaviour modulation. The ontogeny of these systems is considered, as are behavioural changes which occur as a consequence of aberrant neuro-chemical activity. (Open with permission to advanced undergraduates)

- Psychology 49.670F1, W1

Research Seminar in Learning

- Psychology 49.680F1, W1

Special Topics in Psychology

(Same description as 49.580)

- Psychology 49.690F1, W1, S1

Directed Studies

(Same description as 49.590)

- Psychology 49.691F1, W1, S1

Independent Research

(Same description as 49.591)

- Psychology 49.693F, W, S

Practicum in Psychology

The practicum offers graduate students experience in a range of applied psychology settings (for example, hospitals, schools, and correctional centres). Students participate in training sessions and work experience, facilitating the integration of academic and practical aspects of psychology. Details of current practicum placements are available from the department. This course cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory.

- Psychology 49.699F, W, S

Ph.D. Thesis

Through inter-university co-operation in graduate instruction, full-time graduate students registered in the Department of Psychology may enrol in one course at the University of Ottawa.

The Ottawa-Carleton Specialization in Neuroscience

Loeb Bldg. B552
788-7494

The Specialization

Co-ordinator of the Specialization: B.A. Pappas

Neuroscience is the study of the nervous system and its function. This emerging field cuts across many disciplines and incorporates such areas as anatomy, neurobiology, pharmacology, physiology and psychology. While individual researchers usually specialize in a particular area, neuroscientists today must also be able to appreciate significant research in the other fields and therefore require an understanding of the basics of the other disciplines.

Training in the neurosciences extends past the boundaries of traditional departments. In response to the challenge of providing a comprehensive education for future neuroscientists, the University of Ottawa and Carleton University now offer a multi-disciplinary specialization in neuroscience.

The specialization is intended to augment the research and training which the student receives through one of the "primary" departments which are participating in the neuroscience specialization. The departments are:

- Department of Anatomy, University of Ottawa
- Department of Biology, Carleton University
- Department of Biology, University of Ottawa
- Department of Physiology, University of Ottawa
- Department of Psychology, Carleton University
- School of Psychology, University of Ottawa

Five additional departments from the University of Ottawa Medical School are also affiliated.

- Department of Medicine (Division of Neurology)
- Department of Neuropathology
- Department of Pharmacology
- Department of Psychiatry
- Department of Surgery (Division of Neurosurgery)

The specialization is co-ordinated by a committee consisting of representatives from each of the participating departments.

Application should be made to the primary department which is most appropriate to the student's research interest. Once accepted by the department, students must be sponsored into the specialization by a member of the neuroscience faculty.

Application forms and further information can be obtained by writing directly to any of the "primary" departments.

Members of the Neuroscience Specialization
Hymie Anisman, *Stress, Coping, Depression, Catecholamines*

Catherine Bielajew, *Brain-stimulation and Reward, Reward Sites*

Roger Broughton, *Biological Rhythms, Sleep Disorder*
Daniel Coulombe, *Brain Stimulation and Reward, Multivariate Analysis*

Joseph De Koninck, *Sleep Cycles, Biorhythms, Dreams*

Jack De La Torre, *Brain and Spinal Trauma, Central and Peripheral Regeneration, Stroke*

Bruce Ferguson, *Biochemical and Neuronal Models of Child Learning Disorders*

George Fouriez, *Brain Stimulation and Reward, Self-stimulation*

Peter Fried, *Alcohol, Marijuana, Smoking and Pregnancy*

James Fryer, *Neuroendophysiological Hormones, Neuropeptides, Teleost Endocrine Function*

David Gardner, *Patch Clamping; Pesticides, Invertebrate CNS*

Walter Hendelman, *Tissue Culture, Locus Coeruleus, Growth Factors*

Pavel Hrdina, *Antidepressants, Imipramine Binding, Central Neurotransmitters*

Jack Kelly, *Auditory System Structure and Function*

Robert Knights, *Head Injury, Cognition Behavior*

John Kucharczyk, *Neurogenic Hypertension; Cerebral Ischemia, Neural Electrolyte Regulation, MRI Imaging*

Symon Lemaire, *Neuropeptides, Receptor Modulation, Catecholamines*

Leonard Maler, *Decending Pathways, Ion Channels, Neurotransmitters*

Kenneth Marshall, *Neurotransmitters, Locus Coeruleus, Tissue Culture Electrophysiology, Neuronal Development*

Irene Mazurkiewicz-Kwilecki, *Brain Histamine, Aging, Stress, Drug Abuse*

Dan McIntyre, *Epilepsy, Kindling, Learning, Memory*
Zulfikar Merali, *Heavy Metal Toxicology, Monoamines, Bombesin*

Theris Miliaressis, *Psychobiology, Brain Stimulation Reward, Neuroleptics*

Vital Montpetit, *Pyridoxine Neurotoxicity, Alzheimer's Disease, Leukoencephalopathy*

Catherine Morris, *Single Channel Studies, Acetylcholine Activation*

Bruce Pappas, *Locus Coeruleus, Spinal Cord Monoamines, Behavioral Teratology, Hormone-catecholamine Interactions, Developmental Psychopharmacology*

David Parry, *Muscular Dystrophy, Neurotrophic Interactions, Myosin Isoenzymes, Muscle Regeneration*

David Peters, *Brain Development, Stress, Neuropharmacology*

Terence Picton, *Evoked Potentials, Information Processing, Sensory Pathways*

Terry Pivik, *Sleep; Neurophysiology; Psychophysiology, Biological Psychiatry*

David Roberts, *Drug Abuse, Norepinephrine, Brain Metabolism*

William Staines, *Neuroanatomical Tracers, Neurotransmitters*

Donald Stuss, *Frontal Lobes, Closed Head Injury, Dementia; Focal Brain Disease*

Brian Tansley, *Spatial Vision, Retinitis Pigmentosa, Neurotoxicity, Visual, Auditory System*

Tom Tombaugh, *Drug Abuse, Neuroleptics*

Jose-Maria Triafaro, *Neurotransmitter Synthesis, Storage and Secretion*

Ronald Trites, *Dyslexia, Stroke, Head Injury Evaluation*

William Webster, *Functional Lateralization, Stuttering, Motor Skills*

Robert Zacharko, *Intracranial Self-stimulation, Stress, Depression, Dopamine, Anhedonia*

Master's Program

Admission Requirements

The requirements for admission to the Master's neuroscience specialization are as follows:

- Prior admission to the Master's program of the primary department which participates in the specialization.
- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and which indicates the willingness of the faculty member to supervise the candidate's research program.

Students with less than a high honours average in their undergraduate and graduate courses will not normally be recommended for admission.

Program Requirements

In addition to fulfilling the requirements for the master's program of the department in which they are enrolled, the specialization requires that students successfully complete one of the two courses: Basics of Neuroscience or Neuroanatomy and Neurophysiology. The thesis research must concern a neuroscience topic and must be supervised by a member of the neuroscience faculty. The student is expected to join the Ottawa Neurosciences Society and attend its scientific meetings.

Doctor of Philosophy

Admission Requirements

Admission requirements to the Ph.D. neuroscience specialization are as follows:

- Prior admission to the Ph.D. program of the primary department which participates in the specialization.
- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and which indicates the willingness of the faculty member to supervise the candidate's research program.
- Two additional letters of recommendation from University faculty who are familiar with the candidate's academic and research career.

Students with less than a high honours standing in their undergraduate and graduate courses will not normally be recommended for admission.

Selection of master's and doctoral students is carried out by the Neuroscience Specialization Coordinating Committee which will select and rank the admissible candidates. Admission is determined by priority of ranking and the number of admissions depends upon the available positions in the specialization.

Program Requirements

Students must fulfill the Ph.D. program requirements of the department in which they are enrolled. The requirements for the specialization also include the following, some of which may satisfy the Ph.D. requirements of the participating departments:

- Successful completion of the following neuroscience courses: Advanced Seminar in Neuroscience (49.621), Neuroscience Techniques I and II (61.623F1 and 61.624W1) and one of Basics of Neuroscience (49.520) or Neuroanatomy and Neurophysiology (49.623).
- A thesis in the area of neuroscience, which must be defended at an oral examination.

Graduate Courses*

A variety of neuroscience courses are available through the primary departments. These currently include behavioral neuroscience, neuroendocrinology, clinical neuropsychology, neurophysiology, synap-

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

tic transmission and behavioural medicine. Course offerings vary slightly from year to year and a complete listing can be obtained from the specialization co-ordinator.

The following are the five core courses of the curriculum.

- Psychology 49.520T2 (PSY6201)

Basics of Neuroscience

A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology.

(Also offered as Biology 61.534T2)

- Biology 61.623F1 (ANA7400 Fall Term)

Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department.

(Also offered as Psychology 49.624F1)

- Biology 61.624W1 (ANA7400 Winter Term)

Neuroscience Techniques II

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department. The supervisor must be different from that of Biology 61.623F1.

(Also offered as Psychology 49.625W1)

- Psychology 49.620T2

Advanced Seminar in Neuroscience

An advanced seminar course integrating various aspects of neuroscience. EP (Also offered as Biology 61.632T2)

Prerequisite: Psychology 49.520 or 49.623

- Psychology 49.623T2 (ANA5470, PHS5470)

Neuroanatomy and Neurophysiology

An integrated course on the central nervous system given by the departments of Anatomy and Physiology of the University of Ottawa and their invited lecturers.

School of Public Administration

Dunton Tower 1001

788-2547

The School

Director of the School: Gene Swimmer

Associate Director: G. Bruce Doern

Co-ordinator, Specialization in Development

Administration: N.H. Lithwick.

The School of Public Administration was established in 1953 through the assistance of a generous grant from the Atkinson Charitable Foundation.

The school offers graduate programs of study and research in the field of administration leading to a graduate Diploma in Public Administration and the Master of Arts degree. The Department of Political Science offers a Ph.D. degree in public administration and public policy in co-operation with the School of Public Administration. Prospective applicants are urged to evaluate these opportunities carefully in order that they may select the one most suitable to their interests, background, and academic qualifications.

Students are encouraged to acquire French language skills. Undergraduate French language courses may be taken as extra to degree, and many other options are available in the National Capital Region. Students may consult the school.

Diploma in Public Administration (D.P.A.)

This diploma program, which consists of five full courses or the equivalent, is more fully described below. It is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies.

Master of Arts

The M.A. program is designed to provide a balanced exposure to both administrative studies and public policy. It is more fully described on the following pages.

Two main areas of specialization are offered:

- 1) Canadian public administration and policy and
- 2) development administration. The development administration specialization is offered with the co-operation of the Norman Paterson School of International Affairs. Only students who intend to complete the M.A. program are admitted to the development administration specialization. However, these students are eligible to receive the D.P.A. upon completion of the required courses. The requirements of the development administration specialization are described in the section dealing with the Master of Arts.

Ph.D.

The Department of Political Science in conjunction with the School of Public Administration offers an

integrated Ph.D. stream in public administration and public policy. This program is designed to provide an integrated knowledge of theory and practice with emphasis on theories, policy analysis and evaluation, and Canadian and comparative public policy and administration. Details of this program are described in the Political Science entry in this calendar.

Inquiries and requests for further information should be directed to the school.

Graduate Diploma in Public Administration

The Diploma in Public Administration is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. The program consists of five courses and may be taken on a part-time, full-time, or mixed part-time and full-time basis.

The program is based on the recognition that persons with widely varying backgrounds will enter it. Students who successfully complete the D.P.A. program may apply for admission to the M.A. program, at which time they will be considered for admission along with all other applicants. If all of the first-year courses are not taken as part of the D.P.A., they will be required in addition to the final M.A. courses.

Admission Requirements

Admission to the graduate program in public administration is selective. To be considered for admission, an applicant must have a bachelor's degree with at least high honours standing from a recognized university, and must have completed courses in introductory economics (Economics 43.100 or the equivalent) and Canadian government and politics (Political Science 47.200 or the equivalent with the required standing). All students are expected to have a working knowledge of the material in these courses.

Applicants are advised to submit applications before May 1 as enrolment in the school is limited.

Program Requirements

The program consists of five full-course credits, at least four of which must be completed at Carleton. Advanced standing may be granted in one full course (or equivalent) if previous work is judged to be equivalent to courses required in the program. A student who has taken one (or more) of the other required courses prior to admission must substitute another course (or courses) in consultation with the supervisor

of graduate studies. In the event that a part-time student is required by his/her employer to move away from Ottawa, he/she may apply to complete one full course or the equivalent at another university, provided that no transfer of credit was granted on admission.

Students in the Canadian stream are required to complete any five full courses from the following program:

- Admin. 50.500: Public-Sector Managing and the Canadian Political System
- Admin. 50.510: Management Accounting and Administration
- Admin. 50.511: Financial Management
- Admin. 50.522: Macroeconomics for Management and Policy
- Admin. 50.523: Microeconomics for Management and Policy
- Admin. 50.530: Organizational Behaviour I
- Admin. 50.536: Law of Public Authorities I
- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.567: Political Economy of the State
- Admin. 50.568: Policy and Decision Making

Part-time students already admitted to the D.P.A. program under the provisions of previous calendars may adjust their programs to take advantage of the revised program outlined above.

Academic Standing

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the school and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one half-course.

Master of Arts

The master's program is specifically designed to provide the prospective and the mid-career administrator with a balanced exposure to administrative studies and to public policy.

The contemporary manager or administrator is increasingly required to be both a policy adviser and formulator and to have a substantive understanding of the many disciplines and variables associated with the decision-making process in contemporary organizations. University programs can begin to provide some of the foundations that will enable persons to acquire an understanding of the broad financial, legal, economic, political, and social interrelationships that affect decisions in any organization.

The Canadian public administration and policy specialization in the M.A. program is designed to prepare students for managerial, policy, and managerial-support roles in the public services of Canada (federal,

provincial, regional, and municipal), and to accelerate and enrich the education and the development of those already performing such roles. Because it is conducted in conjunction with, and draws upon, a program of advanced research in administrative studies and public policy, it is also designed to meet the educational needs of those who wish to undertake graduate-level work in public policy and management, but who may not have a current commitment to public service careers.

A limited number of Co-op placements are arranged for full-time second-year students. This involves the placement of a senior student in a government or other organization to work at a junior officer level for at least one term. It facilitates the integration of the academic and practical aspects of public administration. It is offered to selected full-time second-year students and is dependent on eligibility and the number of suitable placements that can be developed. Co-op placements are not for credit.

The specialization in development administration, offered in conjunction with the Norman Paterson School of International Affairs, is designed to address the unique nature and problems of developing countries. It is intended to provide students from developing countries, and others with an interest in this field, with the knowledge and skills necessary to function successfully in the particular environments of these countries.

Degree Schedules

The degree can be taken in one of three basic modes: full-time, part-time, or through a mixed part-time and full-time schedule:

- The Full-time Schedule

A full-time student can complete the program in two years (four academic terms), but typically may require a fifth (usually summer) term to complete the requirements, depending upon the amount of advanced standing granted for previous courses.

- The Part-time Schedule

A part-time student normally completes from two to four half-courses during the regular academic year, typically in evening courses. Certain courses are also available during the summer term. The duration of a part-time program normally varies from five to eight years.

- Mixed Part-Time and Full-Time Schedule

This schedule enables the student to alternate periods of full-time and part-time study. Typically, students will begin on a part-time basis, but may study on a full-time basis for at least one semester. Such full-time study, which may commence in either the fall, winter, or spring term, is especially suitable for practising mid-career administrators as it facilitates a flexible sequence for study and normal work periods.

Admission Requirements

To be considered for admission, an applicant must have a bachelor's degree (or equivalent) with at least high honours (Upper Second Class) standing from a recognized university, and must already have completed courses in introductory economics (Economics 43.100 or equivalent) and Canadian government (Political Science 47.200 or equivalent), with the required standing.

All students are expected to have a working knowledge of the material in these courses.

Applicants to the development administration stream will not be required to complete the Canadian government prerequisite. These applicants must, however, satisfy the economics prerequisite prior to admission. In addition, they are advised that they must provide proof of a capacity to study and communicate in English; have a working knowledge of mathematics at least at the high school matriculation level; and, have completed not less than three years of relevant work experience (exclusive of teaching) on development projects or in the areas of development assistance or development planning. Students deficient in any of these areas will be required to rectify these deficiencies prior to being considered for admission. The school normally requires applicants to write the Graduate Record Examination Aptitude Test.

The development administration stream is considered to be a program of full-time study, exclusively. A limited number of scholarships are available for visa students.

Applicants are advised to submit applications before May 1 (and prior to March 1 for the development administration stream) as enrolment in the school is limited. Students applying to the Canadian stream who wish to be considered for financial assistance and scholarships should have their applications in by March 1.

The school also gives special consideration to mid-career applicants. To qualify for mid-career admission, applicants must have spent several years in one of the public services, or be performing managerial or related functions in a private-sector organization and have demonstrated excellence in their performance in these organizations.

The school's admission policy will, of course, be governed by the availability of graduate student space and the need to admit applicants from a variety of disciplines and backgrounds (for example, social sciences, humanities, law, engineering, or science). Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the director, and must also be approved at the time of admission by the dean

of the Faculty of Graduate Studies and Research. In general, a grade of B+ or better is required in equivalent courses to obtain advanced standing.

Program Requirements

The M.A. program comprises 20 half-courses (or the equivalent).

Students generally begin their program with required courses; it is possible, however, to take a mixture of optional and required courses throughout both years, provided that the student has the necessary prerequisites for any specific options selected.

Canadian Public Administration and Policy Specialization

Required Courses

- Admin. 50.500: Public-Sector Managing and the Canadian Political System
- Admin. 50.510: Management Accounting
- Admin. 50.511: Financial Management
- Admin. 50.522: Macroeconomics for Management and Policy
- Admin. 50.523: Microeconomics for Management and Policy
- Admin. 50.530: Organizational Behaviour I
- Admin. 50.536: Law of Public Authorities I
- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.567: Political Economy of the State
- Admin. 50.568: Policy and Decision Making

Unless advanced standing has been granted, full-time students in the Fall term of their first year will take: 50.500; 50.567; 50.523 and one other required course.

In the Winter term, they will take 50.522; 50.530 and, normally, three other required courses.

Students who have successfully completed the requirements for the Diploma in Public Administration and who are unable to continue their M.A. program may be awarded the diploma, provided that four full courses have been taken at Carleton University.

Optional Courses

- One half-course selected from Stream 1 listed below, and
- Two half-courses selected from Stream 2 listed below, and
- Six half-courses selected from any of the streams listed below, or
- A thesis (equivalent to four half-courses) and two half-course options, or
- A research essay (equivalent to two half-courses) and four half-course options

Development Administration Specialization

Required Courses

- Admin. 50.510: Management Accounting
- Admin. 50.511: Financial Management*
- Admin. 50.523: Microeconomics for Management and Policy*

- Admin. 50.530: Organizational Behaviour I*
- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.568: Policy and Decision Making*
- International Affairs 46.507: Theories of Development and Underdevelopment
- International Affairs 46.508: Development Planning: Theory and Practice
- International Affairs 46.537: Macroeconomics in a Development Context

Students who are unable to continue in their M.A. program may be awarded the Diploma in Public Administration provided that they successfully complete the diploma requirements and that four full courses have been taken at Carleton University.

Optional Courses

In consultation with the co-ordinator of the development administration specialization, students must select:

- Ten half-courses from Stream 3 listed below, or
- A special project in development administration (50.597, equivalent to two half-courses) and eight other half-course options from Stream 3.

Stream 1 — Public Policy Analysis

Administration

- 50.501 Policy and Administration in Intergovernmental Relations
- 50.502 The Political Economy of Regulation
- 50.513 Budget Decision Making and Budgeting
- 50.524 Advanced Microeconomics for Policy Analysis
- 50.565 Government-Industry Policy Relations
- 50.566 Science and Technology Policies
- 50.569 Public Choice: Theory and Application
- 50.570, 571, 572, 573 Policy Seminars
- 50.574 Urban Policy Analysis
- 50.575 Advanced Statistical Policy Analysis

Stream 2 — Public Management

Administration

- 50.514 Public-Sector Accounting and Finance
- 50.515 Management in the Public Service
- 50.516 Urban and Local Government Management
- 50.517 Public Management in Developing Countries
- 50.518 Marketing for Non-Profit Organizations
- 50.519 Management of Public Enterprise
- 50.520 Public-Sector Investment and Pricing
- 50.528 Management Information Systems I
- 50.529 Management Information Systems II
- 50.531 Organizational Behaviour II
- 50.537 Law of Public Authorities II
- 50.538 The Management of Provincial Government
- 50.562 Planning and Evaluation in Government I

- 50.563 Qualitative Research in Public Organizations
- 50.581 Staffing and Personnel Management
- 50.583 Problems in Organizational Change and Development
- 50.584 Industrial Relations and Public-Sector Collective Bargaining
- 50.585 Public-Sector Collective Bargaining

Stream 3 — Development Administration

- 50.502 The Political Economy of Regulation
- 50.514 Public-Sector Accounting and Finance
- 50.519 Management of Public Enterprise
- 50.520 Public Sector Investment and Pricing
- 50.528 Management Information Systems I
- 50.529 Management Information Systems II
- 50.536 Law of Public Authorities I
- 50.562 Planning and Evaluation in Government
- 50.563 Qualitative Research in Public Organizations
- 50.565 Government-Industry Policy Relations
- 50.572 Regional Policy
- 50.574 Urban Policy
- 50.597 Special Project in Development Administration (1 credit)

International Affairs

- 46.506 Agriculture and Rural Development
- 46.512 Canada and International Development
- 46.538 International Economics: Policy and Theory
- 46.539 International Financial and Monetary Institutions and Policy
- 46.545 International Organizations in International Affairs
- 46.561 Historical Dimensions of Development and Underdevelopment
- 46.563 Issues in Development in Africa
- 46.564 Issues in Development in Latin America
- 46.565 The Ethical Dimension of International Affairs
- 46.567 Issues in Development in Southeast Asia
- 46.569 Social Cost-Benefit Analysis and Development Project Evaluation
- 46.581 Regional Co-operation Among Developing Countries

Economics

- 43.533 Regulations and Public Enterprise
- 43.543 Public Choice
- 43.547 Project Evaluation
- 43.554 Economic Development: Internal Aspects
- 43.562 International Monetary Theory and Policy

Political Science

- 47.545 Public Administration in Developing Countries

School of Business

- 42.510 Seminar in Management and Administration
- 42.511 Seminar in Organizational Design

*Special sections of these courses will be offered for students in the Development Administration specialization.

Stream 4 — Recommended Options Offered by other Carleton Departments and Schools and by the University of Ottawa

(This is not a complete list of all the acceptable options. Students should contact the supervisor of graduate studies or the director for approval if there are other courses they wish to take which are not on this list.)

Economics

- 43.505 Econometrics
- 43.511 Canadian Economy I
- 43.532 Competition Policy
- 43.533 Regulation and Public Enterprise
- 43.541 Public Economics: Expenditure
- 43.542 Public Economics: Taxation
- 43.547 Project Evaluation
- 43.555 Economic Development: International Aspects
- 43.581 Regional Economics
- 43.582 Urban Economics

International Affairs

- 46.511 Canada in the International Political Economy
- 46.512 Canada and International Development
- 46.513 Canada and International Conflict
- 46.530 International Enterprise
- 46.531 International Industries
- 46.532 Science, Technology, and International Affairs: The Advanced, Industrial Countries
- 46.533 Science, Technology, and International Affairs: The Third World

Journalism

- 28.500 Journalism and Society I
- 28.560 Journalism and Society II

Law

- 51.440 The Arbitration Process in Industrial Relations
- 51.445 Labour Relations in the Public Service
- 51.450 Canadian Constitutional Law
- 51.456 Administrative Law I
- 51.457 Administrative Law II
- 51.556 Advanced Administrative Law Problems

Political Science

- 47.501 Canadian Provincial Government and Politics
- 47.508 The Politics of Energy and the Environment
- 47.544 Public Administration in Developed Western Countries
- 47.545 Public Administration in Developing Countries
- 47.547 Decision Theories and Policy Studies
- 47.561 Analysis of Canadian Foreign Policy

Social Work

- 52.511 Social Policy Analysis
- 52.514 Housing Policy
- 52.515 Poverty and Wealth
- 52.540 Social Administration and Policy
- 52.541 Management of Social Programs
- 52.551 Program Evaluation

Sociology and Anthropology

- 53.525 Canadian Society
- 53.527 Sociology of Formal Organizations
- 53.529 Sociology of Science and Technology
- 53.530 Social Institutions I: Labour Unions: Organizations and Movements
- 53.532 The Labour Process
- 53.540 Political Sociology
- 53.549 The Politics of Social Movements and the State
- 53.568 Women and Work

University of Ottawa

- ADM5320 Marketing
- ADM5380 Management Decision Models
- ADM6320 Marketing Research
- ADM6340 Accounting for Managerial Planning and Control
- ADM6352 Empirical Methods in Financial Economics
- ADM6380 The Modelling of Management Decisions Under Uncertainty

Academic Standing

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the school and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course.

Required Courses*

- Administration 50.500F1
Public-Sector Managing and the Canadian Political System

An examination of the central features and influences of the Canadian political systems on public service managerial and policy roles. An examination of the application of managerial concepts and approaches in Canadian public administration.

V.S. Wilson.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Administration 50.510F1, W1

Management Accounting

An introduction to the underlying assumptions and basic principles of accounting, and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions, and alternative choice problems.

- Administration 50.511F1, W1

Financial Management

An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques of capital expenditure analysis, and analysis of funds flow.

Prerequisite: Administration 50.510.

Calum Carmichael.

- Administration 50.522W1

Macroeconomics for Management and Policy

An examination of macroeconomic theory and policy, with emphasis on the theoretical foundations of contemporary policy debates.

Prerequisite: Administration 50.510.

George Warskett and Stanley Winer.

- Administration 50.523F1

Microeconomics for Management and Policy

An examination of microeconomic theory and policy, with attention to public sector economics.

A.M. Maslove, George Warskett, and Stanley Winer.

- Administration 50.530F1, W1

Organizational Behaviour I

An examination of basic theories and approaches to the motivation of workers in organizations, the analysis of individual behaviour in organizations from the perspective of worker motivations, and the examination of current tools, such as job enlargement participation models and M.B.O. for improving worker motivation and coping with organizational change.

Perequisite: Administration 50.500.

Donald Swartz, Katherine Graham, and Sharon Sutherland.

- Administration 50.536F1, W1

Law of Public Authorities I

Introduction to basic legal principles, structures, and processes for the public administrator. Character of law and public law; constitutional framework; legal sanctions and basic principles of legal control. Statutory discretion from the administrator's point of view.

R.D. Abbott.

- Administration 50.551F1

Quantitative Methods I

An introduction to the theory of measurement and various methods of data collection, causal analysis and inferential statistics.

Gene Swimmer, George Warskett, and Stanley L. Winer.

- Administration 50.552F1, W1

Quantitative Methods II

An examination of techniques and problems of single equation estimation. Students will be expected to devise their own research design and analyze quantitative data with the use of the computer.

Prerequisite: Administration 50.551.

Gene Swimmer, George Warskett, and Stanley L. Winer.

- Administration 50.567F1, W1

Political Economy of the State

An examination of basic theories and interpretations regarding the roles of, and interrelationships among, the state, corporations, labour unions, the professions, and other elements of the private sector.

Rianne Mahon, Frances Abele, and Donald Swartz.

- Administration 50.568F1, W1

Policy and Decision Making

An introduction to major political, economic, and organizational theories of policy and decision making, and their relationship to applied policy analysis.

Prerequisites: Administration 50.500; 50.567 and 50.523.

G.B. Doern, Rianne Mahon, and V.S. Wilson.

- International Affairs 46.507F1

Theories of Development and Underdevelopment

A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

- International Affairs 46.508W1

Development Planning: Theory and Practice

Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

- International Affairs 46.537W1

Macroeconomics in a Development Context

An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.

Optional Courses*

Note: Optional courses may only be taken when the student has completed at least 9 required half-courses or has obtained advanced standing in same.

- Administration 50.503F1 or W1

Policy and Administration in intergovernmental Relations

An examination of the major cost-sharing and fiscal transfer agreements, and the intergovernmental mechanisms for policy and administrative co-ordination in selected policy fields.

V.S. Wilson

• Administration 50.502F1

The Political Economy of Regulation

An examination of political, economic, legal, and organizational theories of regulation in the Canadian and comparative context, and of the processes and consequences of regulatory practice in selected Canadian public policy fields.

Prerequisite: Administration 50.568.

• Administration 50.513F1

Budget Decision Making and Budgeting

A study of selected aspects of the expenditure and revenue budget and budgetary process at all levels of government. Student papers are oriented towards critical review of actual budgets and budgetary processes.

Prerequisites: Administration 50.523 and 50.568.

A.M. Maslove and Stanley L. Winer.

• Administration 50.514W1

Public-Sector Accounting and Finance

An examination of selected problems in accounting and financial management in public-sector organizations.

• Administration 50.515F1

Management in the Public Service

An examination through cases and research of selected problems and issues in public service management. The specific focus of the course will change each year; some topics include human resources management, government investment, and pricing decisions.

• Administration 50.516W1

Urban and Local Government Management

An analysis of the principal issues and processes of Canadian urban and local government management and administration.

Katherine Graham.

• Administration 50.517W1

Public Management in Developing Countries

An applied analysis of selected issues in public management and administration in developing countries.

N.H. Lithwick.

• Administration 50.518W1

Marketing for Non-Profit Organizations

Examination of the concepts of marketing relative to public demand, and the market for social goods and services. Contemporary marketing approaches and practices are analyzed and applied to purposes, programs, and environments of government agencies and departments, educational institutions, charities, and other public and social services.

• Administration 50.519W1

Management of Public Enterprise

An examination of the theory and practice of public enterprise, drawing on both Canadian and comparative experience. The seminar examines selected federal and provincial crown corporations, and mixed enterprises, such as Air Canada, CNR, AECL, Telesat Canada, and the Canada Development Corporation.

• Administration 50.520F1

Public-Sector Investment and Pricing

An examination of theory and practice related to decision making about public-sector investment and pricing policy, particularly in connection with large-scale projects and programs. The focus is applied cost-benefit analysis (discount rates, marginal cost and shadow pricing, and the handling of risk and uncertainty) in large-scale public investment choices.

Prerequisite: Administration 50.523.

A.M. Maslove and Stanley L. Winer.

• Administration 50.524F1

Advanced Microeconomics for Policy Analysis

A course in microeconomics to provide advanced analytical tools to address policy issues in areas such as industrial organization, labour economics, public finance, regulation, and international trade.

Prerequisite: Administration 50.523.

Stanley L. Winer.

• Administration 50.528F1, W1

Management Information Systems I

An examination of the fundamentals of MIS: the nature of systems, information, and management processes, including concepts of data-processing technology, systems design, organizational impacts of information systems, and hardware and software considerations.

• Administration 50.529W1

Management Information Systems II

The objective of this course is to provide the student with the tools to become an intelligent user and manager of an information system. Topics include: structured systems analysis and design; technology assessment; data analysis and design; and systems development life cycle. Students are required to present the results of a major case study of an information system.

Prerequisite: Administration 50.528.

• Administration 50.531W1

Organizational Behaviour II

An examination of macro open-systems theories of behaviour of organizations, including interagency and agency-clientele relations and accountability processes. Students examine through research papers different modes of organization, including ministry systems, state enterprise, mixed enterprise, regulatory boards, and service and custodial organizations.

Sharon Sutherland.

- Administration 50.537F1

Law of Public Authorities II

Characteristics and problems of control of administrative action. Varieties of legal control, judicial review, discretion, privative provisions and damages, appellate control, statutory reform.

Prerequisite: Administration 50.536

- Administration 50.538W1

The Management of Provincial Government

A comparative analysis of public-sector management structures and processes at the provincial level of government. Topics examined include personnel and financial systems, regional administration, public utilities, direct interprovincial program and project management, and international activities of provinces.

Prerequisite: Administration 50.500

- Administration 50.560F1 or W1

Industrial Policy: Theory and Practice

An examination of the main policies, programs and strategies of government departments, federal and provincial, for economic development, with emphasis on Canada.

Manfred Bienefeld and Rianne Mahon.

- Administration 50.562F1, W1

Planning and Evaluation in Government I

An examination of selected concepts, issues, and processes in applied governmental planning and evaluation, utilizing both Canadian and comparative experiences.

Sharon Sutherland and Frances Abele.

- Administration 50.563F1

Qualitative Research in Public Organizations

The course deals with the specification and formulation of research problems, and with the design and conduct of qualitative social research in public sector settings. There is emphasis on tactics to control and summarize information throughout the life of a study, and on techniques for the reduction and presentation of non-quantitative data. Writing and communication skills are stressed. The skills gained are relevant to a number of kinds of analysis typically conducted in bureaucracies, such as program evaluation designs and studies, and implementation analyses.

Prerequisite: Administration 50.562.

Sharon Sutherland.

- Administration 50.566S1

Science and Technology Policies

An examination of Canadian programs, policies, and strategies toward the development of scientific and technological capability, and towards the use of science and technology in social and economic programs.

- Administration 50.569W1

Public Choice: Theory and Application

Understanding the public sector through the building and application of public choice models. Topics include the theory of groups, representative democracy, special interest politics, the bureau, and federal structure.

Prerequisite: Administration 50.523.

A.M. Maslove and Stanley Winer.

- Administration 50.570T2

Policy Seminars

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

- Administration 50.572F1, W1, 50.573S1

Policy Seminars

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

- Administration 50.574F1

Urban Policy Analysis

An analysis of the urban policies of all three levels of government in Canada and their interactions. The course examines policy processes as well as a number of substantive urban policy issues.

N.H. Lithwick.

- Administration 50.575F1

Advanced Statistical Policy Analysis

An examination of econometric research on selected policy issues. The issues considered vary each year and the analysis incorporates the study of selected econometric techniques. The course enables students to evaluate critically applied econometric studies of public policy.

Stanley Winer and George Warskett.

- Administration 50.581W1

Staffing and Personnel Management

An examination of the staff and personnel-management functions in large public and private organizations, including recruitment, selection and performance appraisal, reward systems, and the roles of staffing professionals.

- Administration 50.583F1

Problems in Organizational Change and Development

An examination, through case work and group projects, of the concepts and issues of planned organizational changes.

Prerequisite: Administration 50.530

- Administration 50.584F1

Industrial Relations and Collective Bargaining

An analysis of the basic concepts of industrial relations, with respect to both public- and private-sector employees and organizations.

Gene Swimmer.

- Administration 50.585W1

Public-Sector Collective Bargaining

An application of the basic concepts, legislation, and public policies regarding public-sector collective bargaining at the federal, provincial, and municipal levels of Canadian government. Cases and simulated negotiations will be used where appropriate.

Prerequisite: Administration 50.584 or permission of the school.

Gene Swimmer.

- Administration 50.590T2

Directed Studies

A tutorial or directed reading course on selected subjects.

- Administration 50.591, 50.592, 50.593F1, W1, S1

Directed Studies

A tutorial or directed reading course on selected subjects.

- Administration 50.595T2

Internship Paper

The internship paper is based on the internship placement, but must be distinct from it, and involves the application of relevant theoretical and practical literature to the work assignment. It is developed in consultation with the student's faculty supervisor, and assessed by the faculty. Students should consult the Supervisor of Graduate Studies for details.

- Administration 50.597T2

Special Project in Development Administration

- Administration 50.598F2, W2, S2

Research Essay

- Administration 50.599F4, W4, S4

M.A. Thesis

School of Social Work

St. Patrick's Bldg. 469
788-5601

The School

Director of the School: Roland Lecomte
Supervisor of Graduate Studies: Edith Moore

The School of Social Work, accredited by the Canadian Association of Schools of Social Work, offers a graduate program leading to the degree of Master of Social Work. The program may be completed through full-time or part-time study.

Master of Social Work

The Master of Social Work program is based on an analytical and critical approach to social work practice, and to knowledge related to practice. The program examines the structural context of personal and social problems, and of social work practice. The structural context refers to the interaction between the personal and the social, political, and economic aspects of such problems. The program focuses on the development of forms of practice predicated on this notion, referred to as structural approaches, seeking to intervene to change the nature of the interaction between people and their structural context.

The school's orientation explicitly includes approaches to social problem solving, social development, and social change, which involves working directly with individuals and groups. This includes a strong emphasis on sensitivity to the individual, and on the development of new and innovative strategies for working with individuals in their environments. The school also stresses community analysis and an awareness and knowledge of the social policies that affect the lives of many people in our society. Analyses of class, gender and race relations are considered central to the program.

The program of the school offers two major social work intervention areas. The first area is related to direct practice with individuals, families, groups, and communities. Pressures of society are contributing to the toll of family and individual suffering. Traditional primary institutions such as the family are undergoing modification, and in many cases they no longer provide needed support. It is hoped that skilled social work practitioners can help families, individuals, and communities through some of the crises, and help them to effectively address the personal and societal pressures they are facing.

The second major area of study is social administration and policy. There is a growing awareness that

social work should be more involved in the development of social policies, in the operation of large scale social programs, and in policy analysis and research. Since the school is well situated in the nation's capital, it has a wealth of resources in the social policy and program arenas to draw upon.

The program includes the following major curriculum segments:

- An understanding of social structure and individual and collective behaviour
- An understanding of the methods and processes of social work intervention
- An understanding of the social policy process and social work's participation in it
- Research knowledge and skills, and their application to questions dealing with social work practice, with particular emphasis on the evaluation of social work practice and programs
- Field work, an opportunity for students to test out aspects of the academic curriculum within a practice setting, and to work with professionals involved in social work and related fields.

Part-Time Studies

The school also offers part-time studies to a limited number of candidates each fall. It is anticipated that part-time studies will attract competent candidates who, due to a range of circumstances, cannot participate in a program of full-time study. M.S.W. requirements for part-time studies are identical to the regular program, and the course offerings and timetable for part-time students are the same as for full-time students. Part-time students are permitted to enrol in a maximum of two half-courses per term. They have up to eight years to complete their studies.

Admission Requirements

Admission to the school is on a selective basis.

All applicants will have received their bachelor's degree, or be in their final year of undergraduate study prior to graduating from a recognized university; a high honours standing at the undergraduate level is expected. Applicants must present a one-credit course in basic research methods, and they should have a background in the social sciences. Preference will be given to candidates with related work experience. However, in no case can prior experience be substituted for academic work, including the field instruction requirements.

Applicants with a B.S.W. degree, or graduate work in a related discipline, are considered individually for advanced standing in the program.

Application is made on the forms available from the admissions office of the School of Social Work. The

University deadline for application is July 1 but students are advised to apply by February 1 as enrolment in the school is limited. All applications received after February 1 will normally be considered only for entry into the program in the year following.

Social Science Requirement

Applicants with degrees in the humanities or related fields may be required to take make-up courses in the social sciences. Courses that address societal and personal issues will be considered as equivalent: for example, society, value, and technology; social and political philosophy; social history of Canada; contemporary Canadian cultures; media and society; public issues in Canada; and contemporary labour problems.

Research Requirements

Courses stressing logic of inquiry will be given preference. These may include courses in quantitative and/or qualitative research, philosophical as well as historical approaches to inquiry, and the standard social science research courses.

Program Requirements

Candidates for the Master of Social Work degree must complete 10 full credits of course work (or the equivalent).

All students must complete the courses Social Work 52.500 or 52.506, 52.510, either 52.551 or 52.552 (or one of the specified substitutes below), 52.561 (following the completion of four full credits taken in the school, which must include Social Work 52.500 or 52.506, 52.510, and either Social Work 52.520 or 52.540, or a substitution if advanced standing for any of these is granted) and Social Work 52.590.

B.S.W. students may be considered for advanced standing in certain required and elective courses.

Electives across the program, totalling 4-1/2 credits, are to be accomplished through either a second (two-credit) field placement and the equivalent of 2-1/2 credits of course work, or 4-1/2 credits of optional course work from across the program.

In addition, *Direct Intervention* students must take Social Work 52.520; and *Social Administration and Policy* students must take Social Work 52.540.

Substitutes for Social Work 52.551 or 52.552 are: Sociology 53.511: Research Design and Data Analysis (full-course credit), 53.512 and 53.513: Statistical Methods I and II, and 53.515: Qualitative Methodology; (half-course credits); Anthropology 54.541: Anthropological Methods; Public Administration 50.562: Planning and Evaluation in Government I; Psychology 49.510 and 49.511: Research Methods in Social Psychology I and II; Psychology 49.540: Quantitative Psychology I: Univariate Techniques and Psychology 49.541: Quantitative Psychology II: Multivariate Techniques; Psychology 49.570: Research Methods in Learning; Political Science 47.573: Advanced Research Methods; Economics 43.505:

Econometrics; Economics 43.592: Econometric Methods; and History 24.588: Historiography.

Academic Standing

The school operates within the evaluation and grading system of the Faculty of Graduate Studies and Research.

Graduate Courses*

The following courses are offered in the graduate program, but not all are available in each academic year.

Human Behaviour and Structural Context

- Social Work 52.500F1

Human Behaviour and Structural Context

A general framework for the utilization of social science theory in social work practice is presented, reviewing major contributions from individual and social psychology, and from social, political, and economic theory toward the understanding of the interaction between the personal and the larger social system aspects of problems confronted by social work practitioners. A major analytic focus of the course is the position of women in the family, the paid labour force, and the social services.

- Social Work 52.502W1

Economics of Welfare

An examination of economic aspects of social policy, critically examining several theoretical approaches to the role of government in the financing of social policy. Review of the growth of federal government spending on social welfare, and an examination of the federal tax system and selected social welfare policies.

- Social Work 52.503W1

Foundations of Sexuality

A critical examination of psychological, social psychological, and sociological theories about the nature of human sexuality, and sexual identity and interaction.

- Social Work 52.504W1

Social Work and the Law

Examination of the legal context within which social policy is developed, social programs presented, and social work practised, clarifying the philosophical basis of Canadian law, the relationship between law and the state, and the expression of the law in the judicial system. Special attention is given to a critical analysis of legislation concerning families and children.

*F,W,S indicates term of offering.

Courses offered in the fall and winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Social Work 52.505F or W

Organizational Behaviour and Change

Examination of contemporary theory and research related to the study of complex social organizations with a focus on the role of social workers in the human services. The impact of organizational structures and processes on the users of social and welfare services is also a major part of this course as is the strategic influence of middle management and line staff in the planning of organizational change.

- Social Work 52.506F1

Women and Welfare

This course aims to stimulate and develop critical appreciation of the changing status of women in Canadian society, in specific relation to the field of social welfare, and to develop awareness of the importance of sex differentiation as a key determinant in society. Using women as a primary source of data, the course will examine women as the major providers and consumers of the social services. It will also analyze the implications of social policy decisions for women. Thus, the importance of gender stratification as a major problematic inherent in traditional theories of social class, political economy, the state, ideology, and psychology will be explored. The resultant implications for professional practice at both direct-intervention and social policy levels will be considered.

- Social Work 52.507F1

Foundations of Direct Intervention Practice

This seminar traces the philosophical and historical evolution of the competing paradigms underlying contemporary social work practice, with individuals, families, and collectivities. Most of the analytical content will be drawn from the philosophy of science and from the sociology of knowledge.

- Social Work 52.508F1

Social Deviance and Social Control

A consideration of classical and contemporary theories of deviance, elucidating the nature and theoretical bases of ideas about social problems which are of concern to social workers.

- Social Work 52.509F1, W1

Selected Topics in Human Behaviour

Seminar on a special topic, presented by a faculty member or a visiting professor. The seminar is based on current interests of faculty and students and a availability of special expertise.

Social Policy Analysis

- Social Work 52.510F1

History and Philosophy of Social Welfare

An historical perspective on the development of social welfare policies and the practice of social work, presenting an analysis of such matters as the functions of welfare institutions, the historical relationships between welfare and work, the nature and terms of social provisions, the contrast between residual and institutional welfare policies, and the development of social work practice.

- Social Work 52.511W1

Social Policy Analysis

Based on a framework for the analysis of social problems, the course offers conceptual, theoretical, and empirical tools for the analysis of social policies in meeting social needs or resolving social problems in Canadian society.

- Social Work 52.513W1

Personal Social Services

Examination of a number of issues related to personal social services, including government jurisdiction, financing, access, rationing, present organizational structures, and the nature of services provided. Major current developments are examined, and a perspective on the future of personal social services developed.

- Social Work 52.514F1

Housing Policy

An introductory analysis of the economic and social aspects of housing. Issues include the nature of property, housing finance and construction, rent control, land assembly and development, and housing rehabilitation; also covers the genesis and current state of housing policy at all three levels of government, and the effect of government policy on the distribution of housing.

- Social Work 52.515F1

Poverty and Wealth

Critical examination of theories of poverty and wealth, in an attempt to explain the existence of poverty and the unequal distribution of income and wealth in Canada, then using the perspective developed to focus on existing and prospective Canadian social policies, such as guaranteed annual income schemes and wealth taxation.

- Social Work 52.516W1

Women and Social Policy

A structural approach is used to analyze social policy affecting women. The course will examine the relationship of feminist scholarship to the practical work of developing policy and to policy outcomes for women. It will assess the formal processes of policy making and the impact of the women's movement on them. (This course precludes credit for Social Work 52.542)

- Social Work 52.517W1

Social Policies for Children

A critical examination of social policies in Canada specifically directed towards children, and their underlying social bases in relation to the economic system, the family, and child-rearing practices.

- Social Work 52.518F1, W1, S1

Seminar in Social Policy

In any one year, three additional half-credit social policy analysis courses may be offered focusing on particular fields such as corrections, mental health services, children's services, or health care services, and examining current programs, historical developments, and the major current issues of development.

- Social Work 52.519F1, W1, S1
Seminar in Social Policy
(Same description as 52.518)

Direct Intervention

- Social Work 52.520T2

Direct Intervention

Presentation of a structural framework for social work practice, consonant with the changing paradigm underlying the profession over the past decade, articulating a model of practice, and examining the following aspects of the framework: assessment and interventive approaches; development of analytical and interactional skills; the helping process. Research questions and implications will be continually identified.

- Social Work 52.521W1

Individual and Family Intervention

The development of practice knowledge and skill related specifically to intervention with individuals and with families, examining the implications for assessment and intervention of a structural approach to working with individuals and families, and directing attention to the differential use of current techniques of intervention.

- Social Work 52.522F1

Models of Practice with Individuals and Families

Comparative and critical analysis of contemporary models, that is, "approaches", "intervention methodologies", etc., currently proposed in direct practice. An analytical framework is presented which examines the problems of selection and relevance of such models for a structural approach to practice.

- Social Work 52.523F1

Principles of Group Development

Group development refers to the changes through time in the internal structures' processes, and culture of the group. Based on the assumption that the group is a vehicle in all practice modalities, and that the role of the group leader is that of developing the group to do its own work, the course draws on small-group theory and group-practice theory.

- Social Work 52.524W1

Group Work and Multi-level Intervention

The concept of group environmental competence is the focus around which group work is linked with individual, organizational and community practice. A range of practice settings is explored to arrive at an understanding of how to intervene flexibly at different levels by means of the group and other modalities. The student will also have the opportunity to acquire knowledge in depth pertaining to a particular setting.

- Social Work 52.526W1

Models of Community Practice

Presentation of a framework for analysis of community problem definition, and working this through goal setting, decision making, action strategies, tactics and

evaluation, affording a detailed examination of four major community intervention roles: enabler, organizer, developer, and advocate. The concept of citizen participation is also examined.

- Social Work 52.527F1

Case Studies in Community Practice

This course is concerned with community action in Canada, based on case studies of Canadian experiences, and providing a broad perspective of the types of citizen action and intervention in community processes; emphasis will be placed on practice, relating concepts developed to the past, present, and emerging reality of community work in Canada.

- Social Work 52.528W1

Feminist Counselling

A critical examination and analysis of approaches to women's problems by the helping professions in general, and social workers in particular, emphasizing the developing theory, practice, and literature of feminist counselling which endeavours to combine the personal and political aspects of women's experiences and alternative forms of helping.

- Social Work 52.529W1

Intervention with Children and Youth

Examines preventative and protective social work intervention with children and youth, analyzing the problems involved in neglect, violence and abuse, crisis situations, wardship, "taking-into-care", and problematic behaviours, in the context of the epigenetic stages of maturation, the family in its diverse forms, and the social-political context in Canada.

- Social Work 52.530F1

Social Change and Social Welfare

Exploration and analysis of the major factors in social change, drawing on the relevant work of major social theorists, and on writers such as Gorz, Alinsky and Freire, who have directed themselves more explicitly to issues faced by social workers.

- Social Work 52.531W1

Social Work with People in Conflict with the Law

An analysis of the theoretical framework and social work practice within the Canadian law enforcement apparatus and correctional services. The course emphasizes the role and participation of social work in new areas which deal with the problems of juvenile delinquency and crime.

- Social Work 52.532F1

Cognitive Approaches to Social Work Practice

An examination of a framework for cognitive and behavioural methods which allows critical analyses as well as intervention in the different areas of social work practice. This examination focuses on the link between the behaviour of the client systems (individuals, families, communities, and organizations) and the social structures, processes, and values which occasion it and which must be considered for effective service.

- Social Work 52.533F1, W1

Health and Social Work Practice

An examination of perspectives necessary for social work practice when dealing with the health of clients. Discussion of health care delivery, including economic and ethical consideration, the role of the professions, community care and self-help. The contribution of social work practitioners in working with clients for better health in "traditional" community, employment and alternative areas.

- Social Work 52.538F1, W1, S1

Seminar in Direct Intervention

In any one year three additional half-credit courses in direct intervention may be offered on topics of interest to faculty and students.

- Social Work 52.539F1, W1, S1

Seminar in Direct Intervention

(Same description as 52.538)

Social Administration and Policy

- Social Work 52.540T2

Social Administration and Policy

An introductory methods course, providing an understanding of the values and knowledge required for the effective performance of policy and planning roles in organizational and community settings, covering need assessment as well as administrative, policy, and planning methods, with an emphasis on social welfare and health agencies as the system context for practice.

- Social Work 52.541F1

Management of Social Programs

Development of intervention and analytic skills through concern with the nature of management in the public and voluntary sector, approaches to more effective utilization of organizations and more effective mechanisms for the delivery of human services. Topics include managerial effectiveness, decision-making methods and tools, models of managerial behaviour, and the design of resource requirements, including budget development.

- Social Work 52.543W1

Supervision of Direct Practice

An analysis of the functions performed in the supervisory role in human service organizations, consideration of differential models of supervision, and examination of problems and issues in social work supervision.

- Social Work 52.544F1

Program Implementation Analysis

An examination of factors affecting social program implementation, and issues pertaining to the translation of policies and plans into program realities.

- Social Work 52.549F1, W1, S1

Seminar in Social Administration

In any one year up to three half-credit courses in social administration may be offered on topics of interest to faculty and students.

- Social Work 52.551W1

Program Evaluation

Relying on principles of basic research methods, this course will focus on the issues of planning and conducting research which aims to determine the effects of social programs. Topics include purposes of evaluative research, articulating program components, goal specification, development of measures, experimental and quasi-experimental design, and utilization of findings.

- Social Work 52.552W1

Evaluation of Direct Intervention

Development of a beginning awareness of issues and skills involved in the evaluation of intervention with individuals, families, small groups, and communities. Moving from philosophical and socio-political research perspectives, the seminar focuses on the development of evaluative criteria and analytical frameworks which could be used to determine the relevance and the effectiveness of intervention.

- Social Work 52.559F1, W1, S1

Seminar in Social Welfare Research

In any one year up to three half-credit courses may be offered in research on topics of interest to faculty and students.

Field Practice — Full-Time

- Social Work 52.561F4, W4, S4

Field Practice I

The field placement facilitates the integration of the academic and practical aspects of social work education, providing the opportunity for students to test theory and practice models dealt with in the academic curriculum, and to learn professional responsibility in self-directed learning practice skills; includes a bi-weekly field seminar.

Offered in spring term subject to availability of faculty.

- Social Work 52.562F4, W4, S4

Field Practice II

Second placement students may receive placement supervision outside the normal geographical boundary. (Same description as 52.561)

Prerequisite: Social Work 52.561

Field Practice — Part-Time

- Social Work 52.563F2, W2, S2

Field Practice I

(Same description as 52.561)

- Social Work 52.564F2, W2, S2

Field Practice II

(Same description as 52.561)

Independent Enquiry Project

- Social Work 52.590F2, W2, S2

Independent Enquiry Project

The IEP is designed to contribute to the preparation of social work practitioners through the development of skills in planning and conducting research relevant to social work practice. The IEP should include some

common elements: formulation of a question; a rationale for the importance of the question; theoretical basis for investigating the question. Various research approaches and styles may be used. The student works with a faculty research adviser and the proposal is reviewed by a project reader.

- Social Work 52.591F1, W1, S1

Tutorial on a Selected Topic

Tutorial or reading course on a selected topic.

Offered in spring term, subject to availability of faculty.

- Social Work 52.592F4, W4, S4

Thesis

In special cases where resources permit, students will be allowed to undertake a two-credit independent enquiry project, instead of the one-credit Thesis, Social Work 52.590.

Department of Sociology and Anthropology

Loeb Bldg. B750
788-2587

The Department

Chairman of the Department: John de Vries
Co-ordinator of Graduate Programs in Sociology:
Gordon Irving
Co-ordinator of the Graduate Program in Anthropology: Charles Laughlin

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and the Ph.D. degrees in sociology, and the M.A. in anthropology.

The principal focus of graduate programs in sociology is the organization and development of contemporary societies in comparative context and with particular reference to Canadian society. Specializations in theory and methodology, social stratification and power, cultural and gender studies, and in comparative institutions are offered.

The anthropology program focuses on gaining an understanding of the social other through an emphasis on theoretical analysis, ethnographic studies and developmental issues.

The department strives to achieve a blend of research and formal graduate instruction in its graduate programs.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high honours standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts in Sociology

Admission Requirements

The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will be taken into account in determining an applicant's standing on admission.

Program Requirements

Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

- Three full courses (or the equivalent); under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. Sociology 53.589 is highly recommended, especially for students who at the time of registration have not decided on a thesis topic
- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent) excluding Sociology 53.595; under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level
- Written and oral comprehensive examination in the candidate's area of specialization and program.

Transfer from thesis to course work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B- or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, a candidate may be allowed a grade of C+ in one full course or each of two half-courses.

Master of Arts in Anthropology

Admission Requirements

The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will be taken into account in determining an applicant's standing on admission.

Program Requirements

Master's students in anthropology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

Three full courses (or the equivalent) to include:

- Anthropology 54.541
- Anthropology 54.542
- Two additional credits selected from the anthropology graduate course offerings; from courses offered

in the sociology graduate program (especially in theory and methods); from 400-level courses offered in the sociology and anthropology undergraduate program (with permission of the graduate committee); or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the University may also be selected but normally not in excess of one full course (or the equivalent)

- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent) excluding Anthropology 54.595, consisting of
 - Anthropology 54.541
 - Anthropology 54.542
- Four additional course credits as described in the thesis program above, chosen in consultation with the student's graduate adviser
- A written and oral comprehensive examination in the candidate's area of specialization and program.

Transfer from thesis to course work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B- or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, a candidate may be allowed a grade of C+ in one full course or each of two half-courses.

Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of contemporary societies, both in a comparative context and with particular reference to Canadian society.

The Ph.D. program in sociology normally will be undertaken on a full-time basis; however in exceptional cases the department will consider admission on a part-time basis.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a master's degree (or the equivalent) in sociology, normally with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted into the Ph.D. program, but will normally be required to complete additional course work.

Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

- 10 full courses (or the equivalent), including 53.600, and a dissertation equivalent to a maximum of seven full courses or a minimum of five full courses
- Written and oral comprehensive examinations in three areas of specialization
- Presentation of a dissertation proposal
- Language requirements as stated below
- An oral defense of the dissertation.

Comprehensive Examinations

Each Ph.D. candidate is required to write comprehensive examinations in three of the following areas:

- Theory and Methodology
- Stratification and Power
- Cultural Studies
- Comparative Institutions

At least one but not all three of the examinations must be in the area STRATIFICATION AND POWER.

Subjects of instruction and research subsumed under these four areas are:

1. Theory and Methodology
 - Logic of Social Scientific Enquiry
 - Classical Social Theories
 - Contemporary Social Theories
 - Feminist Theories
 - Research Methodology
2. Stratification and Power
 - Occupations and Formal Organizations
 - Class Analysis
 - Labour Process
 - Political Sociology
 - Race and Ethnic Relations
 - Gender Relations
 - Social Stratification and Mobility
3. Cultural Studies
 - Ideology, Religion
 - Communication and Popular Cultures
 - Socialization and Education
 - Ethnographic Areas
 - Discourse Analysis
4. Comparative Institutions
 - Canadian Society
 - Socio-linguistics
 - Population Studies
 - Social and Economic Development
 - Deviance, Law, and Criminal Justice

Upon petition to the Graduate Programs Coordinator, an approved field in sociology or a related discipline may be substituted for one of the options above. The subjects of instruction and research subsumed under each of the areas are indicative, and may be subsumed under more than one area, depending on the analytic approach adopted.

The comprehensive examinations are to be completed after course requirements for the Ph.D. have been completed. Normally comprehensive examinations must be completed no later than two years or six terms after initial full-time registration and four years or 12 terms after initial part-time registration.

The dissertation proposal is to be presented after comprehensive requirements have been completed. Normally the dissertation proposal must be presented no later than two and one-half years or seven terms after initial full-time registration and five years or 15 terms after initial part-time registration.

Language Requirements

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of the sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

Academic Standing

Candidates must obtain a grade of B- or better in each course and on the comprehensive examinations.

Graduate Courses*

The following is a complete list of all sociology and anthropology graduate courses. Please note that *not all* courses are offered *every* year. Students should consult the University and departmental timetables for a list of courses offered in 1989-90 and their scheduling.

- Sociology 53.500F1 or W1

Classical Sociological Theory

The course focuses on crucial sociological concepts and ideas proposed by the founders of sociology. Particular attention will be given to the contributions of Marx, Weber, and Durkheim; plus others such as Pareto, Comte, and Husserl. These will be situated within the philosophical, epistemological and social changes brought about by industrialization.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Sociology 53.501F1 or W1

Selected Topics in Classical Theory

Topic varies from year to year.

- Sociology 53.502F1 or W1

Contemporary Sociological Theory

The seminar will provide an analysis of major theoretical perspectives in sociology, including social behaviourism; social action theories such as symbolic interactionism, phenomenological sociology, ethnomethodology; and structuralist theories such as structural functionalism, neo-Marxism and critical theory. The seminar will focus on certain methodological and philosophical issues relevant to the analysis of the perspectives.

- Sociology 53.503F1 or W1

Selected Topics in Contemporary Theory

Topic varies from year to year.

- Anthropology 54.504F1 or W1

Ecological Anthropology

This course examines anthropological approaches to the study of human-environment relationships. Topics covered include the influence in anthropology of biological evolutionary theory, and the applicability for humans of ecological models derived from studies of non-human species. Research on the ecology of foraging and horticultural societies will be reviewed, and we will consider how results from such studies of other cultures may provide insights in understanding ecological relations and problems in our own society. Finally, the implications of ecological analyses for the making of social policy will be considered.

- Sociology 53.507F1 or W1

Social Change and Economic Development

A critical examination of studies of change and development in historical and contemporary national and transnational systems.

- Sociology 53.509F1 or W1

Philosophy of Social Science I

The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

- Sociology 53.511T2

Research Design and Data Analysis

An integrated approach to the problems involved in the analysis of quantitative data; research design and procedure and statistical inference are studied. Participants will be required to attend lectures in Sociology 53.370, as well as a discussion group for graduate students only. In addition to the work normally required in Sociology 53.370, graduate students must submit a research paper on a topic related to their interests.

- Sociology 53.512F1 or W1

Statistical Methods I

A course on multiple regression analysis, with a review of basic statistical assumptions and techniques, followed by a detailed discussion of multiple regression analysis as a statistical technique. Particular attention will be paid to the practical problems associated with regression analysis of sociological data.

- Sociology 53.513F1 or W1

Statistical Methods II

The focus will be advanced research methods.

Topics will include distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques, including regression and loglinear models.

- Sociology 53.514F1 or W1

Multivariate Analysis

This course provides advanced instruction in methods and statistics. Consideration will be given to multiple regression, factor analysis, canonical analysis.

- Sociology 53.515F1 or W1

Selected Topics in Social Research

Topic for 1989-90: Qualitative Methodology

An introduction to the collection and analysis of non-numeric data. Students will develop field-work skills such as non-participant and participant observation and interviewing. There will be practice in various ways of recording and analyzing field data, including computer applications. Throughout the course, substantial consideration will be given to the interaction between theory and data which is involved in this type of research enterprise.

- Anthropology 54.516F1 or W1

North-American Native Studies

An examination of selected issues in Canadian Indian, Inuit, and Métis history. The course will explore debates over social change, cultural autonomy, native rights, and government policy.

- Anthropology 54.517F1 or W1

Problems in North American Ethnohistory

This seminar will examine methodological and substantive problems in the history of Canadian native peoples. It will explore controversies concerning the impact of European penetration and colonial policies on inter-tribal relations, cultural identity, and other aspects of native life.

- Anthropology 54.519F1 or W1

Development, Dependency and Gender

This course will examine varieties of "development" and "dependency" theories, and feminist critiques of both, in analyzing gender relations in the Third and Fourth Worlds. Emphasis will be on recent socialist feminist analyses which focus on the impact of a changing gendered division of labour in all aspects of life. Case studies from around the world will be examined to illustrate the impact of "development" on gender inequality and women's lives.

- Sociology 53.520F1 or W1

Comparative Social Systems

The seminar explores both perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies. Major emphasis is placed on the theoretical and methodological issues in comparative research. Included among the topics for discussion are the nature of sociological propositions in comparative research, the problem of conceptual equivalence, research designs, and levels of analysis. Examples are drawn from both classical and contemporary comparative studies.

- Sociology 53.521F1 or W1

Comparative Methods in Social Research

A seminar dealing with current analytical problems and applications of comparative methods in social research. Students are expected to participate in a group research project in which one or more of these methods will be applied.

- Anthropology 54.522F1 or W1

The Anthropology of Underdevelopment

An anthropological analysis of theoretical and historically concrete issues in the study of variable economic systems ranging from domestic subsistence and peasant production to slavery and capital-dominated markets. Special attention is given to non-capitalist modes of production and social formations, theories of economic modernization, and anthropology's contribution to Marxian explanations of the causes and consequences of hinterland poverty and Third World underdevelopment. Debates over the relationship between the decision making, material provisioning, and cultural symbolising processes are also examined.

- Sociology 53.525T2

Canadian Society

A critical examination of sociological models of modern societies and their relevance to Canada. Special attention is given to current research and its application to contemporary issues.

- Sociology 53.526F1 or W1

Sociology of Occupations and Professions

A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.

- Sociology 53.527F1 or W1

Sociology of Formal Organizations

A consideration of the forms and processes of bureaucracy in modern society, government and industry.

- Sociology 53.529F1 or W1

Sociology of Science and Technology

Study of the interaction among science, technology and change in modern societies.

- Sociology 53.530F1 or W1

Social Institutions I

Topic varies from year to year.

- Sociology 53.531F1 or W1

Social Institutions II

Topic varies from year to year.

- Sociology 53.532F1 or W1

The Labour Process

A consideration of the organization of work and production from feudal times to the present. The purpose of the course is to analyze the labour process in advanced capitalist societies by means of the historical comparative method.

- Sociology 53.533F1 or W1

Sociology of Education

The seminar generally concentrates on a specific topic within the larger field of the sociology of education. Among the topics considered will be the relations between education and other social institutions, the structure of educational opportunity, educational systems and organizations, and the sociology of learning.

- Sociology 53.536F1 or W1

Cultural Studies

The object of the seminar is to enhance our understanding of the relations between cultural practices and other social practices in definite social formations. Discussions are grounded through the choice of specific Canadian research on topics such as media, art, music, education, pedagogy, etc.

- Sociology 53.537F1 or W1

Psychoanalysis and Cultural Studies

This course will examine the relationship between psychoanalytic and sociological theory. A particular focus will be on the work of feminist theorists.

- Anthropology 54.538F1 or W1

Sociology 53.538F1 or W1

Feminist Analyses

This course examines various theoretical frameworks which address the analysis of women in society. We will concentrate on recent attempts to fuse feminist and materialist analyses. Emphasis will be placed on the analysis of the sexual division of labour in the family and the economy. Both the anthropological and sociological literature will be utilized.

- Sociology 53.539F1 or W1

Cultural Theory

A survey of developments in European and North American Marxist and Post-Marxist cultural theories of the past quarter century.

- Sociology 53.540F1 or W1

Political Sociology

An examination of the theoretical and empirical work on selected aspects of the state, politics and political behaviour, primarily in North America and Europe.

- Anthropology 54.541F1 or W1

Anthropological Methods

An examination of the philosophy of social science and the basic elements of scientific methods, with particular emphasis upon the problems of anthropological field work.

- Anthropology 54.542F1 or W1

Explanatory Frameworks in Anthropology

An examination of theoretical and methodological problems in anthropological analysis. Alternative approaches to explanation and analysis in anthropology will be considered. These may include Marxism, functionalism, behaviourism, and structuralism, among others, at both the micro and macro levels.

- Sociology 53.544F1 or W1

Race, Ethnicity and Class in Contemporary Societies

Various theoretical approaches concerning the persistence and re-emergence of ethnic and/or racial groups will be examined. Particular emphasis will be given to the intersection and overlap of ethnicity and race with social class.

- Sociology 53.545F1 or W1

Power and Stratification

An examination of theories of elite behaviour, social class, and ideology.

- Sociology 53.549F1 or W1

The Politics of Social Movements and the State

This course investigates the origins, ideologies, strategies and political implications of social and popular movements in North America and Western Europe which have recently tested the legitimacy of advanced capitalist states and industrial systems. Attention is given to the peace, feminist, gay, ecology and anti-racist movements, as well as to the emergence of the New Right. Among the issues explored are the status of popular movements as vehicles for social change and state restructuring, the transformation of oppositional movements into alternative political parties, and the challenge posed by contemporary movements — both progressive and right wing, to western Marxism, left and liberal politics.

- Sociology 53.554S1

Selected Problems in Political Economy I

A research seminar which will explore a selected topic from current research in political economy, such as:

- a) The Sociology of the State
- b) Developments in the Theory of Culture and Ideology
- c) Analysis of the Sociology of the Labour Market
- d) Developments in Socialist-Feminist Theory.

- Sociology 53.555S1

Selected Problems in Political Economy II

(Same description as 53.554S1.)

- Sociology 53.565F1 or W1

Demographic Analysis

A seminar devoted to the intensive study of analytical strategies and techniques employed in demographic research. Attention is also given to mathematical and statistical models used in demography, which are relevant to research in other areas of sociology.

- Sociology 53.566F1 or W1

Selected Topics in Sociology

Topic varies from year to year.

- Sociology 53.567F1 or W1

Ideology, Crime and Law

The purpose of the course is to acquaint students with recent developments in criminological theory. This may include the study of crime and law from the perspective of theories of the state and ideology, the new feminist theories and cultural studies.

- Sociology 53.568F1 or W1

Women and Work

This course examines various approaches and issues concerning women and work. Among the topics which may be considered are housework, occupational segregation in the paid labour force, part-time work, the changing economic structure of work, wage inequality, and state policies with respect to childcare, equal pay and work of equal value, and affirmative action.

- Sociology 53.582F1 or W1

Departmental Seminar

Topic varies from year to year.

- Sociology 53.583F1 or W1

Critical Theory

The seminar will focus on recent developments in critical theory based upon its initial formulation by the Frankfurt School, with emphasis upon particular contemporary theories in a given year, e.g. J. Habermas, H. Willems, etc.

- Sociology 53.584F1 or W1

Modern Marxist Theory

An examination of topics of theory and research in modern Marxist literature; the central focus is on problems of class analysis, the state, and politics in advanced capitalist societies.

- Sociology 53.585F1 or W1

Selected Topics in Sociology

Topic varies from year to year.

- Sociology 53.586F1 or W1

Selected Topics in Sociology

Topic for 1989-90: The Sociology of Language

An analysis of the relation between language and society, with an emphasis on the Canadian situation. Topics will include: demographic and ecological aspects of language communities; factors affecting change in the size and structure of language communities; language use in public domains; correlates and consequences of language characteristics; language planning.

- Anthropology 54.587F1 or W1

Selected Topics in Anthropology

Topic for 1989-90: Institutionalization of Religion

This course will examine the concept of religiosity cross-culturally. The focus will be on the difference between individualized religions (shamanism and spirit quest) and organized religions (secret societies and totemism), and the process of institutionalization. (Also offered as Religion 34.510F1 or W1.)

- Anthropology 54.588F1 or W1

Selected Topics in Anthropology

Topic varies from year to year.

- Sociology 53.589F1 or W1

The Logic of the Research Process

An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.

- Sociology 53.590F1, W1, S1

Tutorial

- Anthropology 54.590F1, W1, S1

Tutorial

- Sociology 53.595F1, W1, S1

Course-Work Comprehensive in Sociology

Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

- Anthropology 54.595F1, W1, S1

Course-Work Comprehensive in Anthropology

Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

- Anthropology 54.596F1, W1, S1

Field Seminar

This course is concerned with the conduct of directed field research, by special arrangement (for individuals or groups), to be combined with readings and papers under the supervision of a faculty member. The course may normally be taken only once in a student's program.

- Sociology 53.599F4, W4, S4

M.A. Thesis

- Anthropology 54.599F4, W4, S4

M.A. Thesis

- Sociology 53.600T2

Doctoral Seminar

An in-depth study of current research in sociology including an enquiry into research techniques, conceptualization and attendant theoretical issues. This course is required of all first-year doctoral students in sociology.

- Sociology 53.601F1 or W1

Selected Topics in Sociology

Topic varies from year to year.

- Sociology 53.690F1, W1, S1

Tutorial

- Sociology 53.699F, W, S

Ph.D. Thesis

Institute of Soviet and East European Studies

Paterson Hall 459
788-2888

The Institute

Director: J.L. Black

An interdepartmental committee was formed in 1963 to foster teaching, research, conferences, and publications in Soviet and East European studies at Carleton. In 1970, a separate department — the Institute of Soviet and East European Studies — was established to administer the interdisciplinary programs developed by the committee. Faculty members from eleven disciplines (art history, economics, German, geography, history, international affairs, law, political science, Russian, sociology, and social psychology) participate regularly in the institute's activities. They are joined on an occasional basis by visiting scholars from outside the University, including invited specialists from the USSR and Eastern Europe.

At the undergraduate level, the institute offers an interdisciplinary B.A. honours program in Soviet and East European Studies. The institute also administers a program of studies leading to a Master of Arts degree in Soviet and East European Studies, the only one of its kind in Canada. The curricula for both programs are offered largely through participating departments. The M.A. program is designed for students wishing to acquire specialized knowledge of the Soviet and East European area, including proficiency in the use of Russian as a research tool; the approach is interdisciplinary with emphasis on the social sciences and history. Students may take advantage of the University's regular academic exchanges with post-secondary institutions in Hungary, Poland, and the USSR.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree in one of the disciplines represented in the program, or who lack sufficient area studies or language training, may be admitted to a qualifying-year program designed to raise their status to that of honours graduates in Soviet and East European studies. Students are expected to achieve high honours standing in qualifying-year courses in order to qualify for admission to the master's year.

To be eligible for admission to the qualifying-year program, an applicant must already have taken some courses in the area of Soviet and East European studies, so that by the end of the program he or she will have satisfied the basic requirements for admission to the master's program. While language training can be offered as part of the qualifying-year program, students should have completed the equivalent of an introductory course in Russian upon entry.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours degree (or the equivalent) in Soviet and East European studies, with at least high honours standing.

Honours graduates in other disciplines are eligible for admission provided they meet the following requirements:

- A knowledge of the Russian language sufficient for its use in research.
- A total of seven full courses (or the equivalent) in the Soviet and East European field should have been taken in no fewer than three different departments
- At least high honours standing.

Candidates deemed to have insufficient preparation in the Russian language or area studies may be admitted, but will be required to complete one or two additional courses. In some cases candidates may be required to enter the qualifying year.

Program Requirements

The specific requirements in the master's program are the following:

- Soviet Studies 55.500 and 55.501, two half-course seminars in Soviet and East European studies, offered specially by the institute, and incorporating the approaches of several relevant disciplines
- Two full courses, or the equivalent, chosen from the following list, with at least one full course (or the equivalent) at the 500 level. Students are advised to check with the relevant departments for final course listings for 1988-89, as changes in curricula may be made too late for inclusion below; some of the following courses are not offered every year. Undergraduate course offerings below the 400 level may be taken by qualifying-year students, and by students in the M.A. program as supplementary to the minimum M.A. course requirements. (See the institute's program description in the undergraduate calendar for a list of these course options.)

Art History

- 11.420 Early Christian and Byzantine Manuscript Illustration
- 11.421 Early Medieval and Byzantine Ivories
- 11.425 Byzantine and Russian Icon Painting

Economics

- 43.486 Comparative Economic Systems I
- 43.487 Comparative Economic Systems II
- 43.586 Comparative Economic Systems I
- 43.587 Comparative Economic Systems II

German

- 22.401 Formal German Speech

History

- 24.460 Selected Problems in Russian History
 24.461 Selected Problems in Soviet History
 24.560 Revolutionary Russia, 1898-1921
 24.580 Problems in International History

International Affairs

- 46.520 Studies in Strategy and Security
 46.521 Studies in Strategy and Security
 46.538 International Economics
 46.582 The Political Economy of East-West Relations
 46.583 Political Economy of Eastern Europe

Law

- 51.420 International Economic Law II
 51.463 Public International Law
 51.464 Human Rights

Political Science

- 47.431 Marxist Thought
 47.432 Contemporary Marxism
 47.461 Soviet Foreign Policy
 47.483 Foreign Policies of East Asian Powers
 47.514 Comparative Communist Politics: Theory and Practice
 47.515 Comparative Communist Politics: Selected Aspects
 47.516 Selected Problems in Soviet Politics
 47.586 Strategy

Russian

- 36.405 Tutorial: History of the Russian Language
 36.435 Tutorial: Special Topic (Literature)
 36.445 Tutorial: Special Topic (Drama)
 36.455 Tutorial: Special Topic (Post-1917 Period)
 36.493 Translation Tutorial
 36.494 Translation Tutorial II

Sociology

- 53.584 Modern Marxist Theory

Soviet Studies

- 55.400 Aspects of Eastern Europe
 55.401 Aspects of Eastern Europe
 55.402 Aspects of USSR
 55.590 Tutorial in Soviet Studies
 55.591 Tutorial in Soviet Studies
 55.592 Tutorial in Soviet Studies
 55.593 Tutorial in East European Studies
 55.594 Tutorial in East European Studies
 55.595 Tutorial in East European Studies
 55.596 Tutorial in East European Studies

Other 400 and 500 level courses may be approved by graduate advisers as ISEES credits if they are deemed appropriate to a particular students' objectives.

- One of the following:

Soviet Studies 55.598, a research essay incorporating the approaches of at least two of the disciplines represented in the program; the research essay must be combined with an additional full course (or the equivalent) chosen from those listed above, and must be defended orally;

or

Soviet Studies 55.599, an M.A. thesis which must combine the interdisciplinary approach with a greater degree of originality than that required of the research essay, and which must be defended orally.

In both cases (55.598, 55.599) the paper should demonstrate that its author is capable of undertaking research in Russian, or in another language used in the Soviet Union, or in Eastern Europe.

All students will be required to pass an examination in Russian to English translation.

Academic Standing

Master's candidates must obtain a grade of minimum B- on all work credited towards the degree.

Graduate Courses*

- Soviet Studies 55.500F1

Interdisciplinary Seminar on the Soviet Union and Eastern Europe

The themes of the seminar vary from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected issues and countries.

- Soviet Studies 55.501W1

Interdisciplinary Seminar on the Soviet Union and Eastern Europe

The themes of the seminar vary from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected issues and countries.

- Soviet Studies 55.590F1

Tutorial in Soviet Studies

A course of directed readings on selected aspects of the Soviet Union, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Soviet Studies 55.591W1

Tutorial in Soviet Studies

- Soviet Studies 55.592S1

Tutorial in Soviet Studies

- Soviet Studies 55.593S1

Tutorial in East European Studies

A course of directed readings on selected aspects of Eastern Europe, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

- Soviet Studies 55.594W1

Tutorial in East European Studies

- Soviet Studies 55.595S1

Tutorial in East European Studies

- Soviet Studies 55.596T2

Tutorial in East European Studies

- Soviet Studies 55.598F2, W2, S2

Research Essay

A research essay on some topic relating to the Soviet Union or Eastern Europe.

- Soviet Studies 55.599F4, W4, S4

M.A. Thesis

Other courses may be available at University of Ottawa.

Officers of the University

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Hon. Gordon Robertson, P.C., C.C., B.A. Saskatchewan, B.A. (Juris.) Oxford, M.A. Toronto, D.C.L. Oxford, LL.D. Saskatchewan, McGill, Toronto, Dalhousie, D. d'Univ. Laval, F.R.S.C.

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 Associate Professor Claudi Persi Haines
 Mr. Jacques Poitras
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 Associate Professor Sinclair Robinson
 Professor W.J. Romo
 Associate Professor P.L. Rosen
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 Associate Professor C.N. Sargent
 Mr. Robert Sirotich
 Professor M.K. Sundaresan
 Professor Eugene Swimmer
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 Mr. James Wylie
 Professor R.W. Yole
 Mr. Wojciech Zielonka

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 Mr. V.J. Chapman
 Professor Michel Gaulin (Clerk of Senate)
 Associate Professor T.P. Wilkinson

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 University of Iowa, Ph.D. Cornell

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 Ph.D. Chicago, F.C.C.E.A. (President Designate)

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Director of the School of Computer Science
 J.R. Pugh, B.Sc., M.Sc. Swansea

Director of the School of Industrial Design
 J.R. Giard, Diploma-Design (Institut des arts appli-
 qués, Montréal), Higher Diploma in Industrial Design
 (City of Birmingham Polytechnic)

Director of the School of Journalism
 Anthony Westell

*Director of the Norman Paterson School of Interna-
 tional Affairs*
 B.W. Tomlin, B.A. McMaster, M.A., Ph.D. York

Director of the School of Public Administration
 Eugene Swimmer, B.A. City College of New York,
 M.A. Chicago, Ph.D. Cornell

Director of the School of Social Work
 Roland Lecomte, B.A., M.S.W. Ottawa, Ph.D. Bryn
 Mawr

*Director of the Institute of Soviet and East European
 Studies*
 J.L. Black, M.A. Boston, Ph.D. McGill

Librarian
 G.H. Briggs, B.A., M.A. Cambridge, Dip.Lib.,
 Dip.Arch. London

Director of Finance
 J.K. Kettles, B.Com. Carleton, C.A.

Director of Health Services
 Mary O'Brien, M.B., Ch.B. Edinburgh, L.M.C.C.

Acting Director of Planning, Analysis and Statistics
 Imelda Mulvihill, B.A. Carleton, B.Ed. Queen's, M.A.
 Carleton

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 3, 1862. The letter is signed by Abraham Lincoln and is addressed to the Senate and House of Representatives. The letter discusses the state of the Union and the progress of the war against the Confederacy. It also mentions the Emancipation Proclamation and the importance of the Union's cause.

2. The second part of the document is a report from the Secretary of the War Department, dated January 10, 1862. The report is signed by Edwin M. Stanton and is addressed to the President. The report discusses the military situation in the South and the progress of the Union's army. It also mentions the importance of the Union's cause and the need for more resources.

3. The third part of the document is a report from the Secretary of the Navy Department, dated January 15, 1862. The report is signed by Gideon Welles and is addressed to the President. The report discusses the state of the Navy and the progress of the Union's fleet. It also mentions the importance of the Union's cause and the need for more resources.

4. The fourth part of the document is a report from the Secretary of the Treasury Department, dated January 20, 1862. The report is signed by Alexander C. Gibson and is addressed to the President. The report discusses the state of the Treasury and the progress of the Union's finances. It also mentions the importance of the Union's cause and the need for more resources.

5. The fifth part of the document is a report from the Secretary of the Interior Department, dated January 25, 1862. The report is signed by Caleb B. Smith and is addressed to the President. The report discusses the state of the Interior and the progress of the Union's land and mineral resources. It also mentions the importance of the Union's cause and the need for more resources.

6. The sixth part of the document is a report from the Secretary of the War Department, dated February 1, 1862. The report is signed by Edwin M. Stanton and is addressed to the President. The report discusses the military situation in the South and the progress of the Union's army. It also mentions the importance of the Union's cause and the need for more resources.

7. The seventh part of the document is a report from the Secretary of the Navy Department, dated February 5, 1862. The report is signed by Gideon Welles and is addressed to the President. The report discusses the state of the Navy and the progress of the Union's fleet. It also mentions the importance of the Union's cause and the need for more resources.

8. The eighth part of the document is a report from the Secretary of the Treasury Department, dated February 10, 1862. The report is signed by Alexander C. Gibson and is addressed to the President. The report discusses the state of the Treasury and the progress of the Union's finances. It also mentions the importance of the Union's cause and the need for more resources.

9. The ninth part of the document is a report from the Secretary of the Interior Department, dated February 15, 1862. The report is signed by Caleb B. Smith and is addressed to the President. The report discusses the state of the Interior and the progress of the Union's land and mineral resources. It also mentions the importance of the Union's cause and the need for more resources.

10. The tenth part of the document is a report from the Secretary of the War Department, dated February 20, 1862. The report is signed by Edwin M. Stanton and is addressed to the President. The report discusses the military situation in the South and the progress of the Union's army. It also mentions the importance of the Union's cause and the need for more resources.

Faculty

The following list comprises those members of the faculty of Carleton University who offered graduate courses or supervised thesis research work during 1988-89 and those who are expected by their department to do so in 1989-90. Those whose names are accompanied by an asterisk are part-time, special or adjunct appointments.

School of Architecture

K.S. Andonian, M.Arch. Yerevan Polytechnic, M.A.Sc., Ph.D. Waterloo

Barry Bell, B.E.S. Waterloo, B.Arch. Waterloo, M.A. (Phil.) Cambridge

Trevor Boddy, B.A. Alberta, M.E.Des (Architecture) Calgary

Ronald G. Brand, B.Arch. McGill, M.R.A.I.C., Ph.D. Montreal

Martin Bressani, B.Sc., B.Arch. McGill, M.Sc. Massachusetts Institute of Technology

Jacques Dalibard*, B.Arch. McGill, M.A.Sc. (Arch.) Columbia, F.R.A.I.C.

John Flanders, Dipl.Arch. Northern Polytechnic School of Architecture, R.I.B.A., F.R.A.I.C.

Charles C. Gordon, B.A. Amherst, Ph.D. North Carolina

Nan Griffiths, Dipl.Arch. The Polytechnic, R.I.B.A.

S. Gulzar Haider, B.Sc. Punjab, M.Sc., B.Arch., Ph.D. Illinois

Enn Kayari, B.Arch. Toronto, M.Arch. Pennsylvania, M.R.A.I.C.

H. Stanley Loten, B.Arch., M.Arch. Toronto, Ph.D. Pennsylvania, M.R.A.I.C.

George F. MacDonald*, B.A. Toronto, Ph.D. Yale

Glen G.D. Milne, B.Arch. Toronto, M.Arch. Pennsylvania

R.E. Osler, Dipl.Arch. The Polytechnic, R.I.B.A., M.R.A.I.C.

Barry Padolsky*, B.Arch. Manitoba, M.Sc. Urban Design Edinburgh, O.A.A., F.R.A.I.C.

Alex Rankin*, Dipl.Arch. Hammersmith, O.A.A., R.A.I.C., R.I.B.A.

Julian S. Smith, B.A. Oberlin, M.Arch. Massachusetts Institute of Technology, M.R.A.I.C.

James W. Strutt*, B.Arch. Toronto, O.A.A., O.A.Q., F.R.A.I.C.

Gilbert F. Sutton, B.Arch. Toronto, M.R.A.I.C.

Donald Westwood, Dipl.Arch. The Polytechnic, R.I.B.A.

Department of Art History

R. Bergmann*, B.L.S. McGill, Ph.D. Marburg

T.J.C. Brasser*, Cands. C.A., Drs. Leiden

Kelly J. Crossman, B.A. Winnipeg, M.A. Toronto, Ph.D. Edinburgh

Lilly Koltun*, B.A. Toronto, M.A. London

Natalie Luckyj, B.A. Toronto, M.A. Toronto

Roger Mesley, B.A., M.A., Ph.D. Toronto

Ruth Phillips, B.A. Radcliffe, M.A. Toronto, Ph.D. London

J.M. Thompson, M.A. Toronto

Department of Biology

C.A. Barlow, M.A. Toronto, Ph.D. Leiden

D.C.W. Brown*, B.Sc., M.Sc. Waterloo, Ph.D. Calgary

M.J. Canny, M.A., Ph.D. Cambridge

G.R. Carmody, A.B., Ph.D. Columbia

Nathalie Chaly, B.Sc. Carleton, M.Sc. Carleton, Ph.D. Laval

H. Damman, B.Sc. Connecticut, Ph.D. Cornell

R.G. Fulcher*, B.A., M.Sc. Carleton, Ph.D. Monash

D.R. Gardner, B.Sc., Ph.D. Southampton

H.F. Howden, M.S. Maryland, Ph.D. North Carolina

V.N. Iyer, M.Sc., Ph.D. Bombay

S.L. Jacobson, B.C.E. Cornell, M.Sc., Ph.D. Minnesota

K.W. Joy, B.Sc., Ph.D. Bristol

W.A. Keller*, B.S.A., Ph.D. Saskatchewan

J.D.H. Lambert, B.Sc. Vermont, M.Sc. McGill, Ph.D. British Columbia

P.E. Lee, B.Sc. Manitoba, M.Sc., Ph.D. Wisconsin
 L.R. Lefkovitch*, B.Sc., D.Sc. London
 M.E. McCully, M.S.A. Toronto, Ph.D. Harvard, F.R.S.C.
 Lubomir Masner*, B.Sc., M.Sc. Charles University, Prague, Ph.D. Czechoslovak Academy of Sciences, Prague
 H.G. Merriam, B.Sc. Guelph, Ph.D. Cornell
 B.L.A. Miki*, B.Sc. Toronto, Ph.D. Carleton
 S.A. Narang*, B.Sc., M.Sc. Panjab, Ph.D. Calcutta
 Anwar Nasim*, B.Sc., M.Sc. Punjab, Ph.D. Edinburgh
 J.M. Neelin, B.A., Ph.D. Toronto
 S.B. Peck, B.S. Kentucky, M.S. Northwestern, Ph.D. Harvard
 V.L. Seligy*, B.Sc., M.Sc., Ph.D. Toronto
 John Sinclair, B.Sc., Dip. in Biophysics Edinburgh, Ph.D. East Anglia
 K.B. Storey, B.Sc. Calgary, Ph.D. British Columbia
 P.J. Weatherhead, B.Sc. Carleton, M.Sc., Ph.D. Queen's
 J.A. Webb, B.Sc., Ph.D. London
 Frank Wightman, B.Sc., Ph.D. Leeds, F.R.S.C.
 D.M. Wood, B.A. Toronto, M.A. Toronto, Ph.D. McMaster
 R.C. Wyndham, B.Sc. McMaster, M.Sc. Guelph, Ph.D. Calgary
 Hiroshi Yamazaki, M.S. Hokkaido, Ph.D. Wisconsin

V.M. Jog, B.Eng. Birla Institute, M.Eng., M.B.A., Ph.D. McGill

M. Kelly*, B.A. Assumption, M.A. Ottawa, Ph.D. Carleton

G.F. Kersten, M.A., Ph.D. Central School of Planning and Statistics, Warsaw

M.N. Kiggundu, B.A. Makerere, M.B.A. Alberta, Ph.D. Toronto

U. Kumar, B.Sc. Agra, M.Sc. Kanpur, M.Sc. Manitoba, Ph.D. Kanpur

V. Kumar, B.Sc. Agra, B.Eng. Roorkee, M.Eng. California at Berkeley, Ph.D. Manitoba, P.Eng.

W. Lawson, B.Sc. McGill, M.B.A. Western, M.A.Sc. Waterloo, Ph.D. York

G.R. Mallory, B.Sc. Bradford, M.A. Leeds, Ph.D. Bradford

J.J. Marshall, B.H.Ec., M.Sc. Manitoba, Ph.D. Western Ontario

W. Michalowski, M.A., Ph.D. Central School of Planning and Statistics, Warsaw

S.P. Pal, B.E. Burdwan, M.S. Wayne State, M.A.Sc. Waterloo, Ph.D. Waterloo, P.Eng.

N.G. Papadopoulos, B.Com. Athens, M.B.A. Washington State, D.B.A. Athens

A.L. Riding, B.Eng., M.Eng. McGill, M.B.A. Sir George Williams, Ph.D. McGill

D.R. Thomas, B.Sc., M.Sc. Carleton, Ph.D. Imperial College

W.L. Weber, B.Sc. Saskatchewan, M.B.A. Western Ontario, Ph.D. Carnegie Mellon

Institute of Canadian Studies

K.M. Abel, B.A. Queen's, M.A. Manitoba, Ph.D. Queen's

M. Bégin, B.A. Montréal, M.A. Montréal

P. Duchemin, B.A., M.A. Toronto, Ph.D. London

P. Harcourt, B.A., M.A. Cambridge

Patricia Smart, B.A. Toronto, M.A. Laval, Ph.D. Queen's

J.M. Vickers, B.A. Carleton, Ph.D. L.S.E.

School of Business

A. Albagli*, M.Sc. Paris, M.B.A. Ottawa, Ph.D. British Columbia

A.J. Bailetti, B.Sc., M.B.A., Ph.D. Cincinnati

G. Betcherman*, B.A. Toronto, M.A. Carleton, Ph.D. University of California, Los Angeles

J.R. Callahan, B.Sc. Carleton, M.A., Ph.D. Toronto

D. Cray, B.A. New College, M.S., Ph.D. Wisconsin

L.E. Duxbury, M.Sc., Ph.D. Waterloo

J.A. Goldak, M.Sc., Ph.D. Alberta

G.H. Haines, Jr., S.B. M.I.T., M.S., Ph.D. Carnegie Institute of Technology

L.A. Heslop, B.H.Sc., M.Sc. Guelph, Ph.D. Western Ontario

Department of Chemistry

- J.W. ApSimon, B.Sc., Ph.D. Liverpool, F.C.I.C.
 R.G. Barradas, B.Sc. Liverpool, Ph.D. Ottawa, C.CHEM., F.R.S.C.(U.K.), F.C.I.C.
 A.D.O. Bawagan, B.Sc. Philippines, M.Sc. Houston, Ph.D. British Columbia
 G.W. Buchanan, B.Sc., Ph.D. Western Ontario
 P.H. Buist, B.Sc., Ph.D. McMaster
 C.L. Chakrabarti, B.Sc. Calcutta, M.Sc. Birmingham, Ph.D., D.Sc. Queen's, Belfast, C.CHEM., F.R.S.C.(U.K.), F.C.I.C.
 R.J. Crutchley, B.Sc. Toronto, Ph.D. York
 O.E. Edwards*, B.Sc. Alberta, M.S., Ph.D. Northwestern, F.C.I.C., F.R.S.C.
 B.R. Hollebone, B.Sc. Carleton, Ph.D. London
 J.A. Koningstein, D.Sc. Amsterdam
 Peeter Kruus, B.Sc. Toronto, Lic. Tech. Denmark, Ph.D. Toronto
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M. Opalski*, Ph.D. Ottawa

G. Ozornoy, Ph.D. Toronto

Adam Podgorecki, Law D. Jagiellonski, Ph.D. Warsaw

Teresa Rakowska-Harmstone, B.A. McGill, A.M. Radcliffe, Ph.D. Harvard

George Roseme, A.B. California, M.A. Sacramento State

Milada Selucky*, JUDr. Charles, C.Sc. Czechoslovak Academy of Sciences

Radoslav Selucky, Grad.Dip., C.Sc. Prague

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J.W. Strong, M.A. Boston, Ph.D. Harvard

Paul Varnai, M.A. Montréal, Ph.D. Michigan

Department of Spanish

Francisco Atienza, B.T. Salamanca, Lic. T. Innsbruck, Lic. J.C. Rome, D.J.C., D.S.T. Ottawa

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R.L. Jackson, M.A., Ph.D. Ohio State

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J.-Y. Le Boudec*, Bac. St.-Brieuc, Ph.D. Rennes

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M. Niktash*, B.Eng. Arya-Mehr, M.Eng. McGill, Ph.D. Carleton

Bernard Pagurek, M.A.Sc., Ph.D. Toronto

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J.S. Riordon, M.Eng. McGill, D.I.C. Imperial, Ph.D. London

H.M. Schwartz, B.Eng. McGill, M.Sc., Ph.D. M.I.T.

A.U.H. Sheikh, B.Sc. Lahore, M.Sc., Ph.D. Birmingham

W.A. Sullivan, B.Eng. Lakehead

C.M. Woodside, B.A.Sc. Toronto, Ph.D. Cambridge

Calendar of Milestones

The Institution

1941

The Ottawa Association for the Advancement of Learning was established to develop Carleton College. The next year the College offered only evening classes in introductory university subjects, with some courses in public administration.

1943

The incorporation of the Ottawa Association for the Advancement of Learning.

1945

Beginning of day classes and full-time teaching in arts, science, journalism, and first-year engineering. Establishment of the Faculty of Arts and the Faculty of Science.

1946

Move from rented premises to First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in journalism and public administration.

1947

The College committed itself to develop pass and four-year honours programs.

1949

First undergraduate pass degrees in arts, science, and commerce awarded. Formation of Senate.

1950

First honours degrees in arts and science awarded.

1952

The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College and confirmed the power to grant degrees. Property for Rideau River campus acquired.

1953

Establishment of the School of Public Administration.

1954

Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus, and to design the first group of buildings. First honorary degree of LL.D. conferred on Dag Hammarskjöld, Secretary-General of the United Nations.

1955

First Master of Arts degree awarded.

1957

The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

1958

First Master of Science degree awarded.

1959

Move to Rideau River campus, following construction of the Henry Marshall Tory Building (science), the Maxwell MacOdrum Library, and Norman Paterson Hall (arts).

1961

First Ph.D. degree in science awarded. First degrees in engineering awarded.

1962

Southam Hall, the University Commons, Renfrew House and Lanark House (residences) completed. Norman Paterson Hall extended, and University Union opened.

1963

First Master of Engineering degree awarded. Reorganization into the Faculties of Arts, Engineering, Science, and Graduate Studies.

1964

The C.J. Mackenzie Building (engineering) completed.

1965

The E.W.R. Steacie Building (chemistry), Grenville House and Russell House (residences), Maintenance Building, and Heating Plant completed.

1966

First Ph.D. degree in engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories). Establishment of the Schools of International Affairs and Commerce.

1967

Loeb Building (social sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

1968

First Ph.D. degree in arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

1969

Controlled Environmental Facility (biology), Administration Building, Glengarry House (residence), and University Commons (residence cafeteria) completed.

1970

University Centre and Parking Garage completed.

1971

Arts Tower completed.

1972

Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973

St. Patrick's College moves to new facility on the Rideau River campus. First degrees in architecture awarded. New athletic complex containing 50-metre pool and fitness centre opened. School of Industrial Design established.

1974

Faculty of Graduate Studies expanded into Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts programs in anthropology and in religion approved for September 1975. Program leading to Certificate in Teaching of English as a Second Language established.

1975

Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science. First students enrol in public policy and management program offered jointly with the University of Ottawa.

1976

First Dunton Alumni Award presented, January 1976. Creation of the Paterson Centre in March 1976. Division of the Faculty of Arts into two separate faculties: the Faculty of Arts and the Faculty of Social Sciences, effective July 1976. First Master of Journalism degrees awarded, November 1976.

1977

Opening of the Criminology and Corrections Program at St. Patrick's College, April 1977.

1978

School of Continuing Education established. Credit courses offered on cable television for first time. Institute of Biochemistry established.

1979

St. Patrick's College ceased to operate as an academic unit of the University. Academic programs of the college continue as University programs, except for the Unified Liberal Arts Program.

1980

Establishment of the School of Computer Science. Establishment of the Chair of Office Automation in the Faculty of Engineering.

1981

Establishment of the Ottawa-Carleton Institute for Graduate Studies and Research in Chemistry, a joint program with the University of Ottawa. Establishment of a joint Ph.D. program in economics with the University of Ottawa.

1982

Establishment of the Ottawa-Carleton Centre for Geoscience Studies, representing the combined research strengths of Carleton University and the University of Ottawa, with programs leading to M.Sc. and

Ph.D. degrees in most areas of geology. Establishment of a joint master's program in computer science with the University of Ottawa.

1983

Establishment of four joint graduate programs with the University of Ottawa: the Ottawa-Carleton Centre for Graduate Studies and Research in Biology; the Ottawa-Carleton Centre for Graduate Studies and Research in Physics; the Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering; and the Ottawa-Carleton Graduate Specialization in Neuroscience.

1984

Establishment of three joint graduate programs with the University of Ottawa in the areas of civil engineering, mechanical and aeronautical engineering, and mathematics and statistics.

1985

Master of Management Studies program established in the School of Business. The School of Public Administrations offers a concentration in development administration in conjunction with the Norman Paterson School of International Affairs. An additional floor on one wing of the Herzberg Laboratories for Physics is constructed to house the School of Computer Science.

1986

The Social Sciences Research Building, the first new building on campus in a decade, is built to accommodate the rapidly-expanding research activity in the Faculty of Social Sciences. Construction of an annex on top of the Architecture Building to provide additional space for the Faculty of Engineering.

1987

The Institute of Women's Studies is established. The Arts Tower is renamed Davidson Dunton Tower/Édifice Davidson Dunton in honour of Arnold Davidson Dunton, former Carleton University President and Director of the Institute of Canadian Studies. Major revisions to the Undergraduate Exchange Agreement with the University of Ottawa extend opportunities for students to study at both universities. The University launches the Carleton University Challenge Fund, the largest fund-raising campaign in its history.

1988

Canada's first full Bachelor of Engineering program in Aerospace Engineering is established. Bell Northern Research Limited and the Natural Sciences and Engineering Research Council provide funding for an Industrial Research Chair in Computer-Aided Engineering within the Department of Electronics. The Departments of Electronics and Systems and Computer Engineering are major partners in the Telecommunications Research Institute of Ontario (TRIO), one of seven "centres of excellence" chosen by the provincial government for scientific research. The Faculty of Science introduces co-operative education programs in computer science and biochemistry/biotechnology.

Presidents

1942 — 1947

Henry Marshall Tory

1947 — 1955

Murdoch Maxwell MacOdrum

1955 — 1956

James Alexander Gibson (acting)

1956 — 1958

Claude Thomas Bissell

1958 — 1972

Arnold Davidson Dunton

1972 — 1978

Michael Kelway Oliver

January 1 — May 15, 1979

James Downey (pro tempore)

1979 — 1989

William Edwin Beckel

1989 —

Robin H. Farquhar

Chancellors

1952 — 1954

Harry Stevenson Southam

1954 — 1968

Chalmers Jack Mackenzie

1969 — 1972

Lester Bowles Pearson

1973 — 1979

Gerhard Herzberg

1980 —

Gordon Robertson

Special Lectures

Special Lectures at Carleton University

The Munro Beattie Lecture

This lecture was established in 1985 in honour of Alexander Munro Beattie, the founder and first Chairman of the Department of English, in recognition of his outstanding contribution to Carleton University in teaching, scholarship and administration. The series is sponsored by the Department of English.

The Davidson Dunton Research Lecture

Established in 1983, the Davidson Dunton Research Lecture is presented by a Carleton University scholar who is active in research and has achieved international recognition. The lecture is in honour of former Carleton University President Arnold Davidson Dunton.

The Gerhard Herzberg Lecture

Established in 1975 by the Faculty of Science, this lecture honours Gerhard Herzberg, former Chancellor of Carleton University and recipient of the 1971 Nobel Prize for Chemistry. The purpose of the lecture is to emphasize the relationship between science and society and to address an aspect of science which has a pronounced impact on our daily lives.

The Marston LaFrance Research Fellowship Lecture

The fellowship was established in 1979 by the Faculty of Arts in memory of Marston LaFrance, former Professor of English and Dean of Arts at Carleton University. Each year, the recipient presents a seminar or public lecture on some aspect of the research conducted while on fellowship.

The C.J. MacKenzie Lecture

The C.J. MacKenzie Lecture is sponsored by the Dean of the Faculty of Engineering in memory of Chambers Jack MacKenzie, former Chancellor of Carleton University. The first lecture in the series was held during the 1986-87 academic year.

The McMartin Memorial Lecture

The McMartin Memorial Lecture is presented in alternate years by the Department of Religion at Carleton University and the Faculty of Graduate Studies at the University of Ottawa. The series was established in 1969 and is funded by Mrs. J.P. Gilhooly of Ottawa in memory of her parents, Mr. and Mrs. John McMartin. The lectures involve themes which promote the importance of ethical, moral, and religious standards to education and living.

The Adam Mickiewicz Memorial Lecture

Established in 1969, the Adam Mickiewicz Memorial Lecture is presented each year by noted authorities in the area of Soviet and East European Studies. The series is sponsored by Carleton University's Institute of Soviet and East European Studies and the Adam Mickiewicz Foundation of Canada to commemorate Poland's foremost poet, Adam Mickiewicz.

The Lester B. Pearson Chair of International Affairs Lecture

Established in 1976, the chair is named in honour of Lester B. Pearson, former Chancellor of Carleton University and Prime Minister of Canada. The lecture is presented by the incumbent of the Lester B. Pearson Chair of International Affairs.

The Pickering Lecture

The Pickering Lecture is sponsored by the Department of Psychology at Carleton University and the Pickering Institute for Living in Ottawa. This annual lecture focuses on problems of developmental and childhood psychology.

The Alan B. Plaunt Memorial Lecture

The lecture was established in 1957 through a gift from an anonymous donor in memory of Alan B. Plaunt, a distinguished Canadian who was active in many projects of national and civic importance in the 1930s. Each year, a Canadian, who is involved in contemporary issues and committed to a distinctively Canadian quality of life, is given the opportunity to speak out on any aspect of Canadian life.

The John Porter Memorial Lecture

This annual lecture is sponsored by the Faculty of Social Sciences in memory of John Porter, former Vice-President (Academic) at Carleton University and a distinguished sociologist. The series was established in 1982.

The Technology, Society, Environment Committee/Faculty of Arts Lecture

This lecture series was established in 1981 by the Technology, Society, and Environment Committee and the Faculty of Arts. The purpose of the annual lecture is to sensitize the public to the impact of technology on society and the environment.

The Philip E. Uren Memorial Lecture

The Philip E. Uren Memorial Lecture is sponsored by the Dean of the Faculty of Social Sciences in memory of Philip Uren, former Director of the Institute of

Soviet and East European Studies, the Norman Paterson School of International Affairs, and the Paterson Centre for International Programs at Carleton University. This annual lecture was established in 1982.

The Florence Bird Lecture

This annual lecture was established in 1987 to explore the experiences of women in Canada and abroad. It is named in honour of the Honourable Florence Bird, in recognition of her work for the CBC, CIDA, the Royal Commission on the Status of Women in Canada, and the Senate. The lecture is sponsored jointly by the Faculties of Arts and Social Sciences.

The H.H.J. Nesbitt Lecture

This annual lecture series was established in 1987 by the Faculty of Science in honour of H.H.J. Nesbitt, Carleton University's first Dean of Science. The lectures are presented by Carleton alumni who have earned international recognition as scientists. The topics are of general interest to the public as well as the scientific community.

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